AC Power
For *Business-Critical Continuity™*

# *Liebert® FPC™ With VPMP*

*User Manual - 15 kVA -300kVA, 3 Phase, 50 & 60 Hz*

EMERSON
Network Power

# TABLE OF CONTENTS


**1.0 INSTALLATION INSTRUCTIONS . . . . . 2**
1.1 Unpacking and Installation . . . . . 2
1.1.1 Unpacking and Preliminary Inspection . . . . . 2
1.1.2 Handling Considerations . . . . . 2
1.1.3 Unit Preparation . . . . . 5
1.1.4 Location Considerations . . . . . 5
1.1.5 Floor Pedestal Installation . . . . . 7
1.2 Additional Distribution Mounting and Wiring . . . . . 8
1.2.1 Liebert FDC Distribution Mounting . . . . . 8
1.2.2 Distribution Cabinet Electrical Connections . . . . . 8
1.3 Power and Control Wiring . . . . . 9
1.3.1 Input Power Connections . . . . . 9
1.3.2 Junction Box Installation . . . . . 14
1.3.3 System Grounding . . . . . 15
1.3.4 Grounding Electrode Conductor for Liebert® FPCs With Transformer . . . . . 16
1.3.5 Output Power Connections . . . . . 18
1.3.6 Control Wiring Connections . . . . . 20
1.3.7 Adapter Board . . . . . 24
**2.0 EQUIPMENT INSPECTION AND STARTUP . . . . . 25**
2.1 Internal Inspection . . . . . 25
2.2 Startup . . . . . 25
**3.0 INSPECTION AND STARTUP CHECKLIST . . . . . 27**
3.1 Inspection . . . . . 27
3.2 Startup . . . . . 27
3.3 Monitoring System Checklist . . . . . 29
3.4 Equipment Connection Check-Out of Units With Distribution Cables . . . . . 30
**4.0 OPERATING INSTRUCTIONS . . . . . 31**
4.1 Startup Procedures . . . . . 31
4.1.1 Emergency Shutdown—If Emergency Power Off switch is supplied . . . . . 31
4.1.2 Normal System Shutdown . . . . . 31
4.1.3 Normal System Turn On . . . . . 31
4.1.4 Manual Restart . . . . . 31
4.1.5 Auto Restart . . . . . 31
4.2 Basic Monitor Panel . . . . . 32
4.3 Power Monitor Panel . . . . . 33
4.4 Liebert Current Plus Monitoring (If Supplied) . . . . . 35
4.5 Liebert Distribution Monitoring (If Supplied) . . . . . 37
**5.0 MAINTENANCE . . . . . 39**
5.1 Repair . . . . . 39
5.2 Inspection and Cleaning . . . . . 39
5.2.1 Inspection Schedule . . . . . 39

# FIGURES


Figure 1 Typical cabinet and floor planning dimension data, 23" (584mm) cabinet, 15-125 kVA . . . . . 3
Figure 2 Typical cabinet and floor planning dimension data, 47" (1194mm) cabinet 50-300kVA . . . . . 4
Figure 3 Recommended minimum service and ventilation clearances . . . . . 6
Figure 4 Floor pedestal details . . . . . 7
Figure 5 Electrical connection location for 23" (584mm) cabinet . . . . . 10
Figure 6 Electrical connection location for 47" (1194mm) cabinet . . . . . 10
Figure 7 Electrical connection location for 47" cabinet with Square D I-Line panelboard . . . . . 11
Figure 8 Low-voltage control junction box connections, typical . . . . . 15
Figure 9 Main input junction box connections, typical . . . . . 15
Figure 10 Typical grounding arrangements . . . . . 17
Figure 11 Typical Liebert® FPC™ equipment arrangement . . . . . 19
Figure 12 Simplified shutdown circuit . . . . . 20
Figure 13 Typical low-voltage junction box (if used) control wiring for units without monitoring . . . . . 21
Figure 14 Typical low-voltage junction box (if used) control wiring for units with monitoring . . . . . 22
Figure 15 Control wiring for units without low-voltage control box . . . . . 23


# TABLES


Table 1 23-inch cabinet weight . . . . . 3
Table 2 47-inch cabinet weight and heat output . . . . . 4
Table 3 Liebert® FPC™ heat output . . . . . 6
Table 4 Suggested minimum input wire size data . . . . . 12
Table 5 Main input circuit breaker interrupting rating . . . . . 13
Table 6 Main input junction box electrical connections (4 wire) . . . . . 14
Table 7 Main input junction box without transformer electrical connections (5 wire) . . . . . 14
Table 8 Low-voltage (control) junction box dimensions, typical . . . . . 14
Table 9 Main input (power) junction box dimensions, typical . . . . . 15
Table 10 Minimum grounding electrode conductor size (AWG) . . . . . 16
Table 11 Panelboard main circuit breaker torque specifications . . . . . 26
Table 12 Branch circuit breaker torque specifications . . . . . 26
Table 13 Terminal block compression lug torque specifications . . . . . 26
Table 14 Torque specifications, general . . . . . 26

## IMPORTANT SAFETY INSTRUCTIONS

**NOTE**
*Read the entire manual before installing or operating the system.*

# WARNING

Risk of cutting metal bands under tension. Can cause injury and death.

The shipping bands may be under tension. Use appropriate eye, face and hand protection to safeguard against injury from band backlash.

# WARNING

Risk of electric shock and arc flash. Can cause equipment damage, injury and death.

Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the unit.

Equipment inspection and startup should be performed only by trained personnel wearing appropriate safety headgear, gloves, shoes and glasses. Lethal voltages are present during startup procedures. Electrical safety precautions must be followed throughout inspection and startup.

Only properly trained and qualified service personnel wearing appropriate safety headgear, gloves, shoes and glasses should perform maintenance on the Liebert® FPC™ system. All voltage sources to the unit must be disconnected before inspecting or cleaning within the cabinet.

Lethal voltages exist within the equipment during operation. Observe all warnings and cautions in this manual. Failure to comply may result in serious injury or death. Obtain qualified service for this equipment as instructed.

The monitoring system contains a lithium battery for memory backup. There is a danger of explosion if battery is incorrectly replaced. Replace only with same or equivalent type. Dispose of used batteries according to the manufacturer's instructions.

**NOTE**
*The unit should not be loosened from the shipping pallet until all handling by fork lift or pallet jack is completed.*

*All power and control wiring should be installed by licensed electricians and must comply with the NEC and applicable codes.*

**ELECTROMAGNETIC COMPATIBILITY**—The Liebert FPC complies with the limits for a Class A digital device, pursuant to Part 15 of FCC rules.

Operation is subject to the following conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Operating this device in a residential area is likely to cause harmful interference that users must correct at their own expense.

The Liebert FPC complies with the requirements of EMC Directive 2004/108/EC and the published technical standards. Continued compliance requires installation in accordance with these instructions and use of accessories approved by Emerson.

# 1.0 INSTALLATION INSTRUCTIONS

## 1.1 Unpacking and Installation

**NOTE**
*Read the entire manual before installing and operating the system. Upon receipt of a* Liebert® FPC™*, the installer should perform the following steps to ensure a quality installation.*

### 1.1.1 Unpacking and Preliminary Inspection

A quality installation begins on the receiving dock.

1. Inspect the shipment for damage or signs of mishandling before unpacking the unit(s). Check the Shock-Watch™ indicator.
2. If the Liebert FPC was shipped in an export crate, open the shipping crate carefully.
   Use care to avoid puncturing the container with sharp objects that would damage the contents.
3. Remove the packing and vapor barriers and inspect the equipment for any obvious shipping damages.

**NOTE**
*The units should not be loosened from the shipping pallet until all handling by forklift or pallet jack is completed. Complete internal inspection should be accomplished only after equipment positioning and prior to electrical hookup.*

4. If any damage is observed, immediately file a damage claim with the shipping agency and forward a copy to:
   Liebert Corp.
   1050 Dearborn Drive
   P.O. Box 29186
   Columbus, Ohio 43229 USA

### 1.1.2 Handling Considerations

The Liebert FPC is bolted to a wooden pallet to allow handling by forklift equipment.

The Liebert FPC is furnished with casters to allow the unit to be rolled into place after it has been unbolted from the pallet. The unit should be kept on the shipping pallet until it has been moved by forklift as close as practical to its installation location.

Refer to the cabinet drawings furnished with the Liebert FPC for the unit's size and weight. Typical cabinet dimensions and weights are shown in **Figures 1** and **2**.

The route to the Liebert FPC's installation area should be planned to ensure that all passages, including doorways, elevators, ramps and hallways, are large enough to accommodate the unit and that the floors are strong enough to support the weight. Determine whether any corners or offsets would cause problems in maneuvering the unit.

Emerson recommends removing the exterior side panels, if supplied, before the unit is moved. This will prevent scratches, dents and other damage to the panels.

**Figure 1 Typical cabinet and floor planning dimension data, 23" (584mm) cabinet, 15-125 kVA**

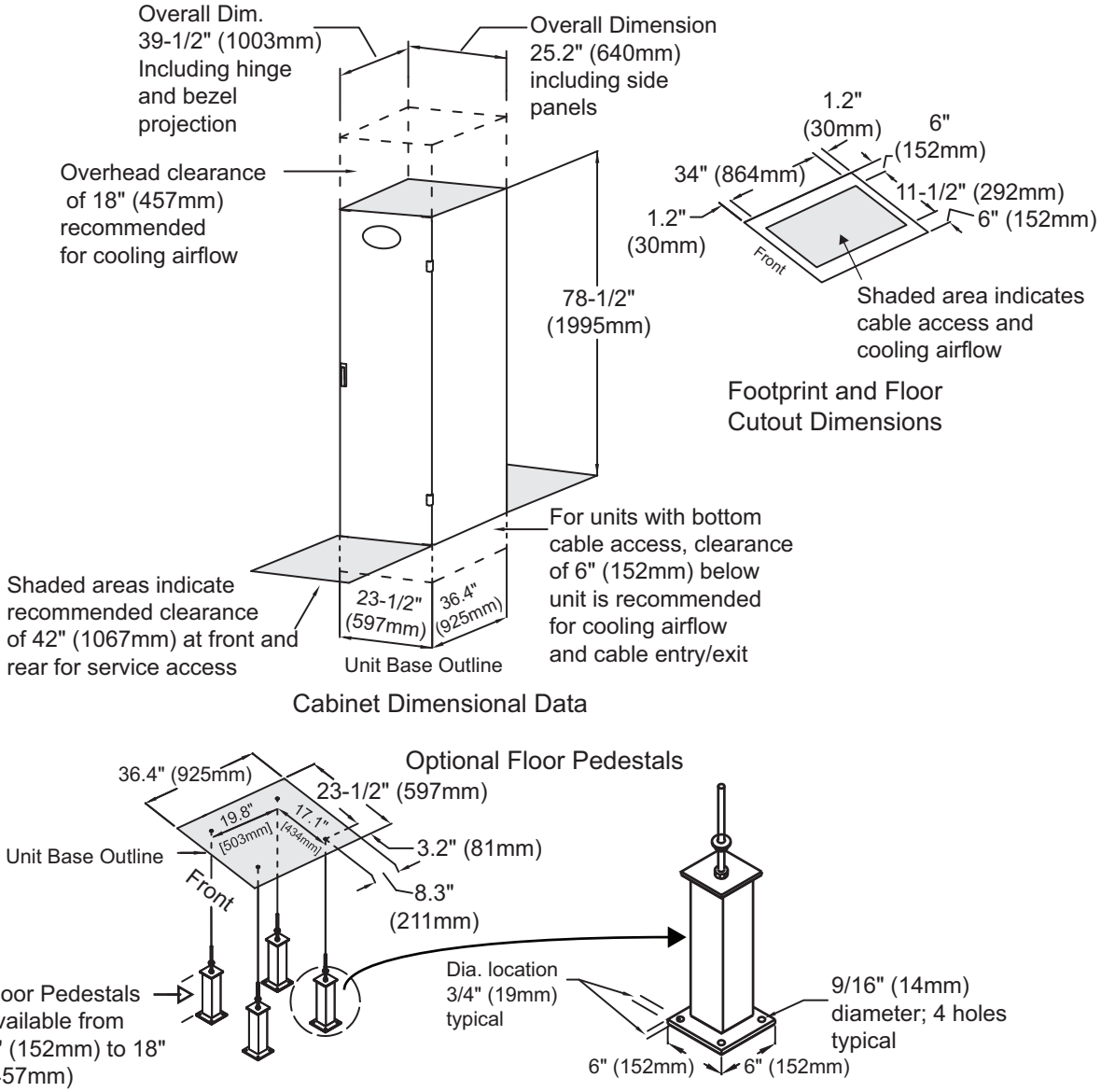



**Table 1 23-inch cabinet weight**

| Unit kVa | Weight, lb (kg) | | |
|---|---|---|---|
| | 60Hz | 50Hz | Without Transformer |
| 15 | 1010 (458) | 1060 (480) | 750 (340) |
| 30 | 1090 (494) | 1140 (517) | 750 (340) |
| 50 | 1160 (526) | 1235 (560) | 750 (340) |
| 75 | 1350 (612) | 1450 (658) | 800 (363) |
| 100 | 1540 (699) | 1665 (755) | 800 (363) |
| 125 | 1650 (748) | 1775 (805) | 800 (363) |

**Figure 2 Typical cabinet and floor planning dimension data, 47" (1194mm) cabinet 50-300kVA**

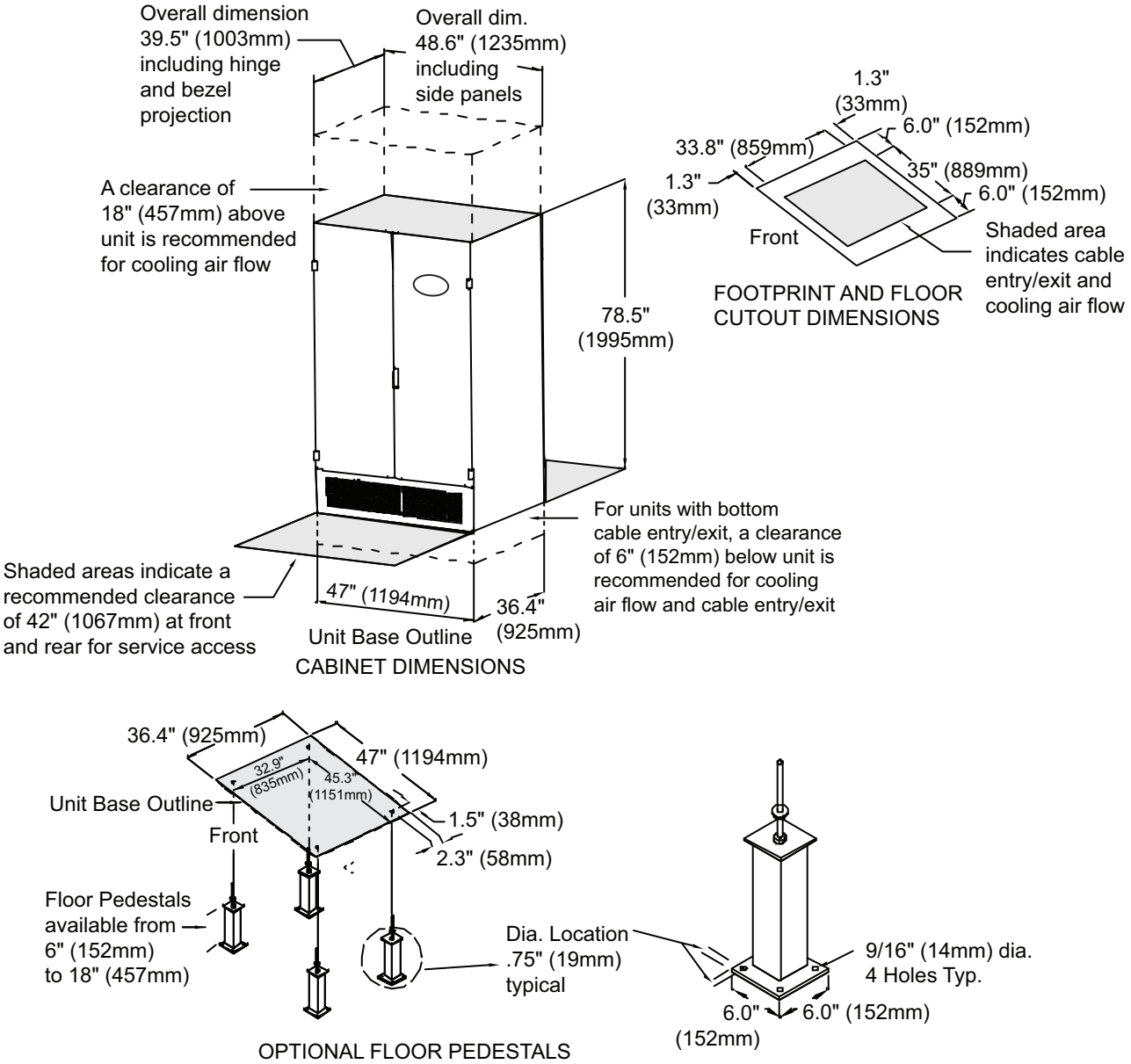

Overall dimension 39.5" (1003mm) including hinge and bezel projection
Overall dim. 48.6" (1235mm) including side panels
A clearance of 18" (457mm) above unit is recommended for cooling air flow
78.5" (1995mm)
For units with bottom cable entry/exit, a clearance of 6" (152mm) below unit is recommended for cooling air flow and cable entry/exit
Shaded areas indicate a recommended clearance of 42" (1067mm) at front and rear for service access
47" (1194mm)
36.4" (925mm)
Unit Base Outline
CABINET DIMENSIONS
1.3" (33mm)
6.0" (152mm)
33.8" (859mm)
35" (889mm)
1.3" (33mm)
6.0" (152mm)
Front
Shaded area indicates cable entry/exit and cooling air flow
FOOTPRINT AND FLOOR CUTOUT DIMENSIONS
36.4" (925mm)
47" (1194mm)
32.9" (835mm)
45.3" (1151mm)
Unit Base Outline
Front
1.5" (38mm)
2.3" (58mm)
Floor Pedestals available from 6" (152mm) to 18" (457mm)
Dia. Location .75" (19mm) typical
9/16" (14mm) dia. 4 Holes Typ.
6.0" (152mm)
6.0" (152mm)
OPTIONAL FLOOR PEDESTALS

**Table 2 47-inch cabinet weight and heat output**

| Unit kVA | Weight, lb (kg) | | |
|---|---|---|---|
| | 60Hz | 50Hz | Without Transformer |
| 50 | 1891 (858) | 1966 (892) | 1335 (606) |
| 75 | 1995 (905) | 2095 (950) | 1335 (606) |
| 100 | 2191 (994) | 2316 (1051) | 1335 (606) |
| 125 | 2298 (1042) | 2423 (1099) | 1360 (617) |
| 150 | 2490 (1129) | 2640 (1198) | 1360 (617) |
| 200 | 2610 (1184) | 2810 (1275) | 1360 (617) |
| 225 | 2800 (1270) | 3000 (1361) | 1390 (631) |
| 300 | 2845(1290) | 3045 (1381) | 1390 (631) |

### 1.1.3 Unit Preparation

The Liebert® FPC™ may be easily removed from the shipping pallet and installed by customer personnel. A typical procedure is as follows:

1. Set the palletized assembly in a level area where there is enough room to roll the Liebert FPC off the pallet onto the floor.
2. Cut the shipping bands.

**WARNING**

Risk of cutting metal bands under tension. Can cause injury and death.

The shipping bands may be under tension. Use appropriate eye, face and hand protection to safeguard against injury from band backlash.

3. Remove the factory-provided ramp from its shipping position.
   One ramp is provided for every five units.
4. Place the ramp adjacent to the pallet to provide a smooth path from pallet to floor.
5. Remove side panels from the Liebert FPC, if supplied. An Allen wrench for the side panels is furnished in the installation packet.
6. Remove the bolts and two mounting brackets holding the unit to the shipping pallet.
   Mounting brackets are located on either side of the unit.
7. Roll the unit off the pallet onto the floor.
8. Roll the Liebert FPC to the installation area. For units to be placed on a raised floor, use care when positioning unit over the floor cutout to prevent the casters from falling through the cutout.

**NOTE**

*Before maneuvering the unit into its final position, read and follow all advisories in **1.1.4 - Location Considerations***

### 1.1.4 Location Considerations

The Liebert FPC should be placed near the load(s) it will supply, preferably within the data center.

Equipment location should employ the shortest output distribution cable runs consistent with logical equipment arrangement and allowance for expansion.

The Liebert FPC is intended for indoor installation in an area with ambient temperatures of 32°F to 104°F (0°C to 40°C) with a relative humidity of 0% to 95% (non-condensing).

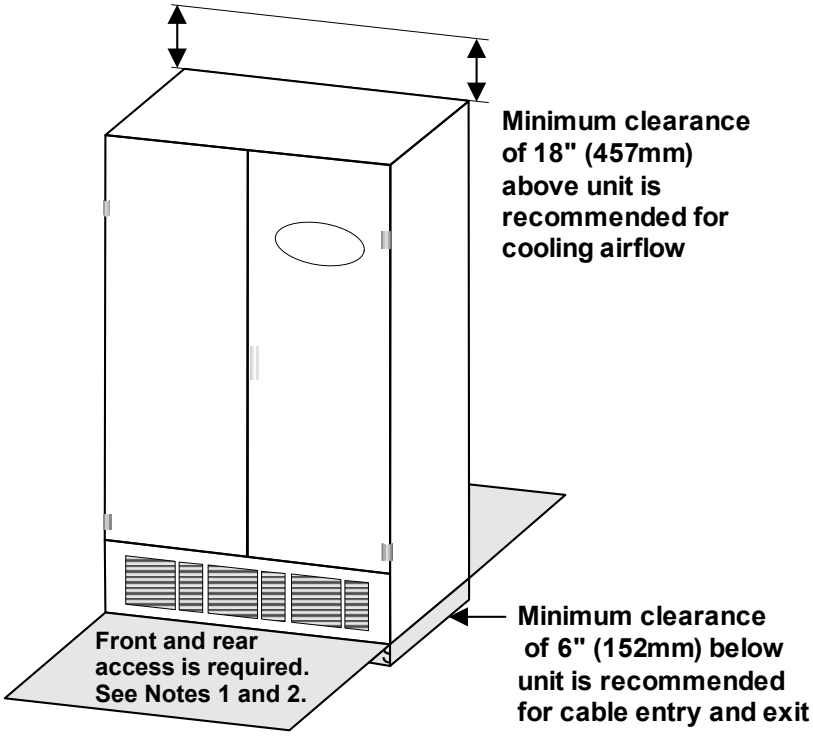
Bottom clearance is required for units with bottom entry/exit of cables. This clearance may be provided by a raised floor at least 6" (150mm) high. **Figures 1** and **2** show the typical raised-floor cutout dimensions for cables and cooling airflow.

When units are not installed on a raised floor, or if the raised floor will not support the unit, optional floor pedestals may be used. (CSA regulations require Liebert FPC arrangements employing a raised floor. Non-raised floor applications are not CSA approved.) Units with top cable exit provisions do not require bottom clearance.

Recommended minimum service clearances are shown in **Figure 3**. The National Electrical Code (NEC) requires the indicated front and rear clearances for service access. Clearance above the unit is required for cooling airflow (exhaust).

As do all electrical devices, the Liebert FPC produces heat under normal operation. (See **Table 3**.) This heat must be accounted for when calculating the environmental conditions of the room.

**Figure 3 Recommended minimum service and ventilation clearances**




**NOTE**

1. *Service access is required at the front and rear.*
2. *Service access clearance dimensions: 36" (914mm) for units up to 150V to ground. 42" (1067mm) for units over 150V to ground.*

**Table 3 Liebert® FPC™ heat output**

| Unit kVA | Full Load Heat Output BTU/Hr (kW) |
|---|---|
| 15 | 2,500 (0.73) |
| 30 | 4,600 (1.35) |
| 50 | 6,200 (1.82) |
| 75 | 8,150 (2.39) |
| 100 | 9,900 (2.90) |
| 125 | 11,500 (3.37) |
| 150 | 12,500 (3.66) |
| 200 | 15,500 (4.54) |
| 225 | 15,800 (4.63) |
| 300 | 18,450 (5.40) |

### 1.1.5 Floor Pedestal Installation

Floor pedestals are optional equipment that provide clearance for bottom cable entry or exit for Liebert® FPC™ units not installed on raised flooring. The pedestals are adjustable over a limited range (approximately 3-1/2" [89mm]) to allow leveling the Liebert FPC and minor adjustments in the unit's installed height.

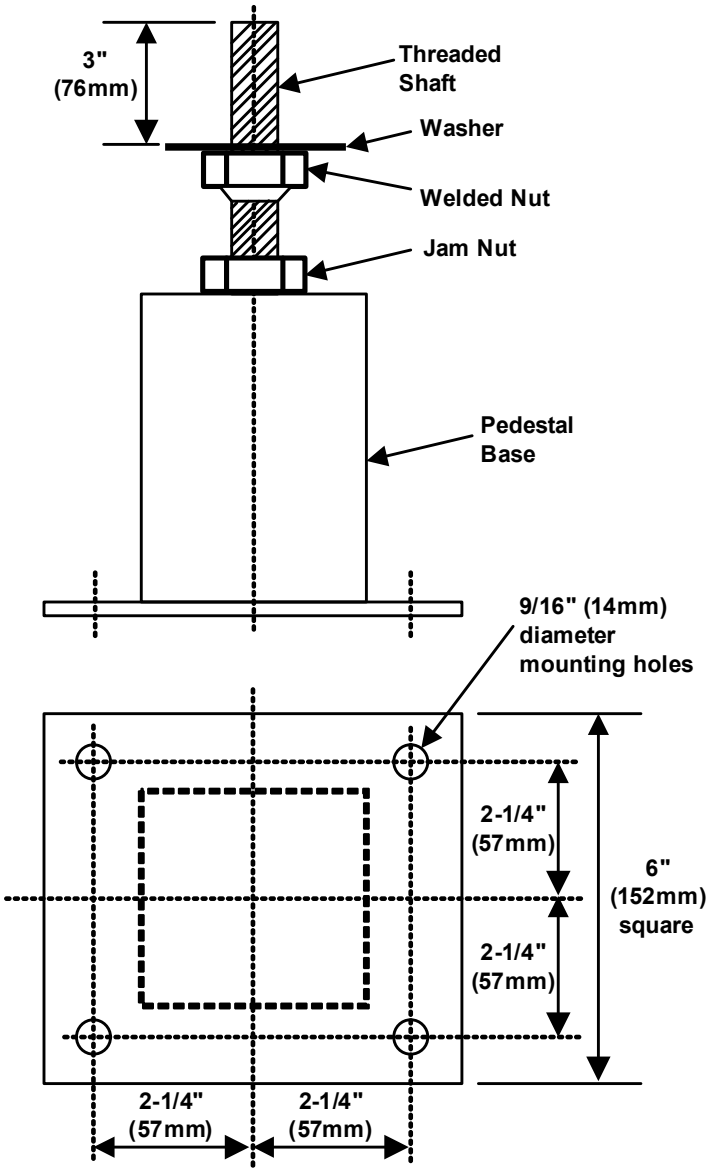
**NOTE**

*Floor pedestals may be reverse-assembled for shipping. Before installation, the pedestals should be reassembled as shown in* ***Figure 4****. When the pedestal is properly assembled, the washer on top of the welded nut provides a bearing surface for the unit's weight.*

1. Insert the pedestal threaded shaft into the pedestal holes in the cabinet base as shown in **Figures 1** and **2**.
2. Adjust the pedestal height by turning the welded nut/shaft assembly into or out of the pedestal base as required.
3. Lock the height by tightening the jam nut against the pedestal base.

   The pedestal may be anchored to the floor by means of the four holes in the base. Locations of floor pedestals are shown in **Figures 1** and **2**.

**Figure 4 Floor pedestal details**



## 1.2 Additional Distribution Mounting and Wiring

For Liebert® FPC™s with more than four panelboards, the additional panelboards are furnished in Liebert FDC™ enclosures, which are shipped separately from the Liebert FPC.

### 1.2.1 Liebert FDC Distribution Mounting

The Liebert FDC distribution cabinet has the same base dimensions as a 23" (584mm) Liebert FPC cabinet (23-1/2" wide x 38" deep [597 x 965mm]) and may be mounted on either the left or right side of the Liebert FPC.

1. Provide a floor cutout for exit of output cables, as shown in **Figure 1**.
2. Remove the side panel, internal panel and the lower panel bracket from the Liebert FPC.
3. Remove the Liebert FDC side panel and internal panel, if supplied, and align the Liebert FDC with the Liebert FPC and bolt the units' frames together (hardware provided by others).

   If floor pedestals are used for the Liebert FPC, two additional floor pedestals are required for the outside corners of the Liebert FDC. See **Figure 1**.
4. Install the lower panel bracket on the opposite side of the Liebert FDC cabinet.
5. Make electrical connections. For details, see "Electrical Field Connections" drawings supplied with the unit.
6. Install the Liebert FPC side panel on the Liebert FDC cabinet.

### 1.2.2 Distribution Cabinet Electrical Connections

Five field-supplied conductors (3-phase conductors, neutral and ground) are needed to connect the Liebert FDC cabinet to the Liebert FPC cabinet in the field.

For Liebert FPCs with transformers, the distribution cabinet phase conductors are connected directly to the transformer terminals:

Phase A to X1
Phase B to X2
Phase C to X3

The Liebert FDC's neutral and ground conductors are connected to the Liebert FPC's neutral busbar and main ground busbar (see unit wiring diagram for location).

For Liebert FPCs without transformers, the distribution cabinet phase and neutral conductors are connected to the corresponding output power distribution terminal blocks inside the Liebert FPC. The distribution cabinet ground conductor is connected to the main ground busbar.

For Liebert FPCs with VPMP monitoring, route each distribution cabinet conductor through the appropriate current transformer (CT) in the Liebert FPC.

**NOTE**
*Distribution cabinet conductors must pass through the current transformers in the same direction as the Liebert FPC panelboard conductors. Use the existing Liebert FPC panelboard wiring for reference.*

## 1.3 Power and Control Wiring

Power and control wiring should be installed by licensed electricians. All power and control wiring must comply with the NEC and applicable local codes.

### 1.3.1 Input Power Connections

If the Liebert® FPC™ is furnished with a main input junction box, input power connections are made as detailed in **1.3.2 - Junction Box Installation**.

If a junction box is not furnished, the input power feeder is connected to the main input circuit breaker located inside the Liebert FPC. (See **Figures 5** through **7**.)

**WARNING**

Risk of electric shock and arc flash. Can cause injury and death.

Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the Liebert FPC.

To minimize disturbances from other loads in the building, the 3-phase power input to the Liebert FPC should be supplied directly from the service entrance or other power source (a dedicated power feeder).

The input feeder circuit should be sized in accordance with the NEC and any local building codes to ensure the feeder's ability to safely carry the system's full load current, including losses.

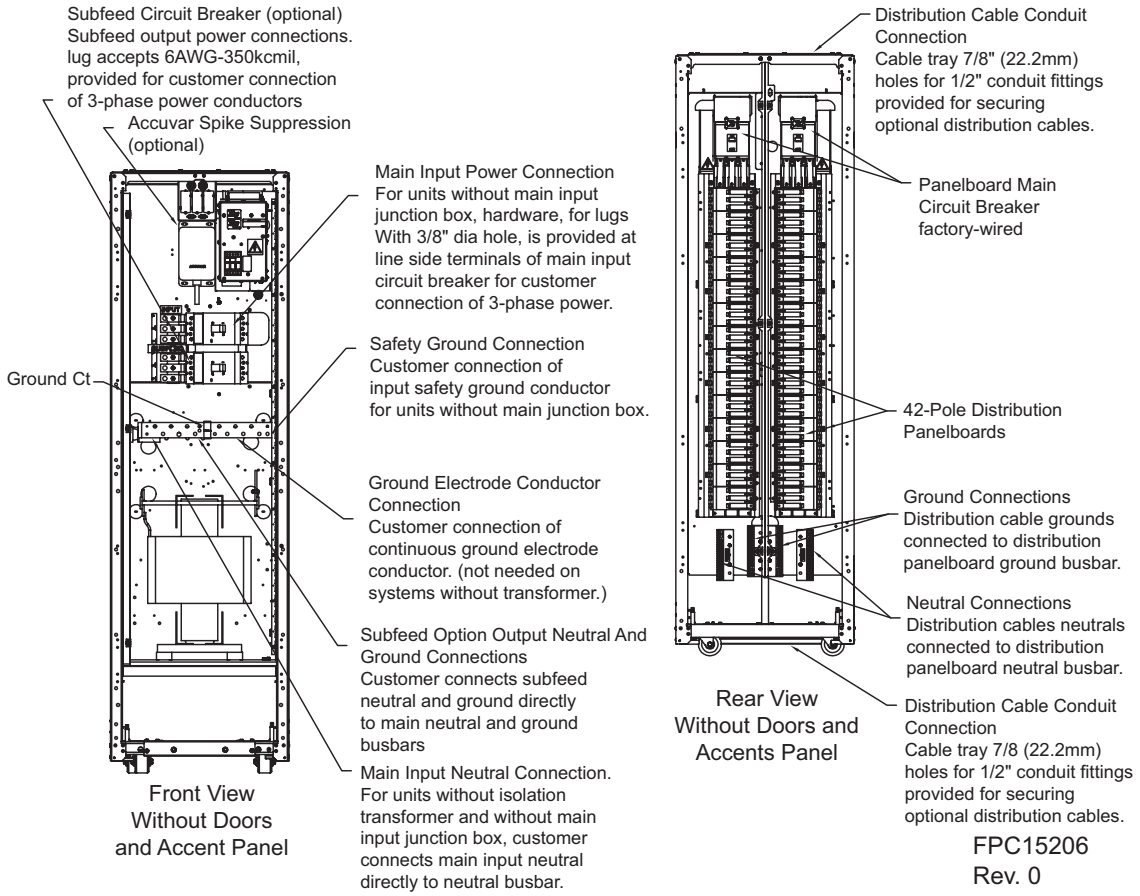
Input feeder conductors should be sized for no more than 2% voltage drop. If operation at undervoltage conditions for extended periods of time is desired, the input feeders must be oversized.

Typical conductor size data is shown in **Table 4**. All connections must comply with the NEC and all other applicable codes.

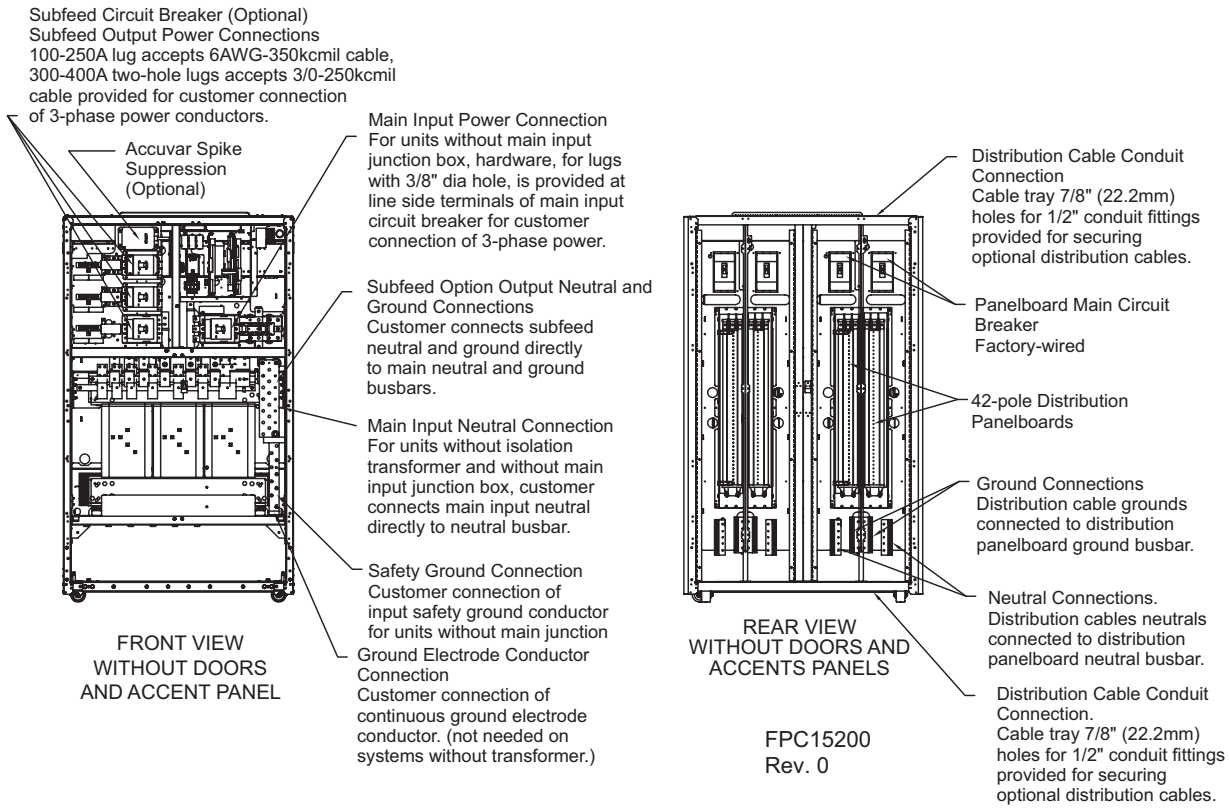
For units with a transformer, the main input feeder should consist of 3-phase conductors and one (safety) ground conductor (3W + G).

For units without a transformer, the main input feeder must consist of 3-phase conductors, one neutral and one (safety) ground conductor (4W + G).

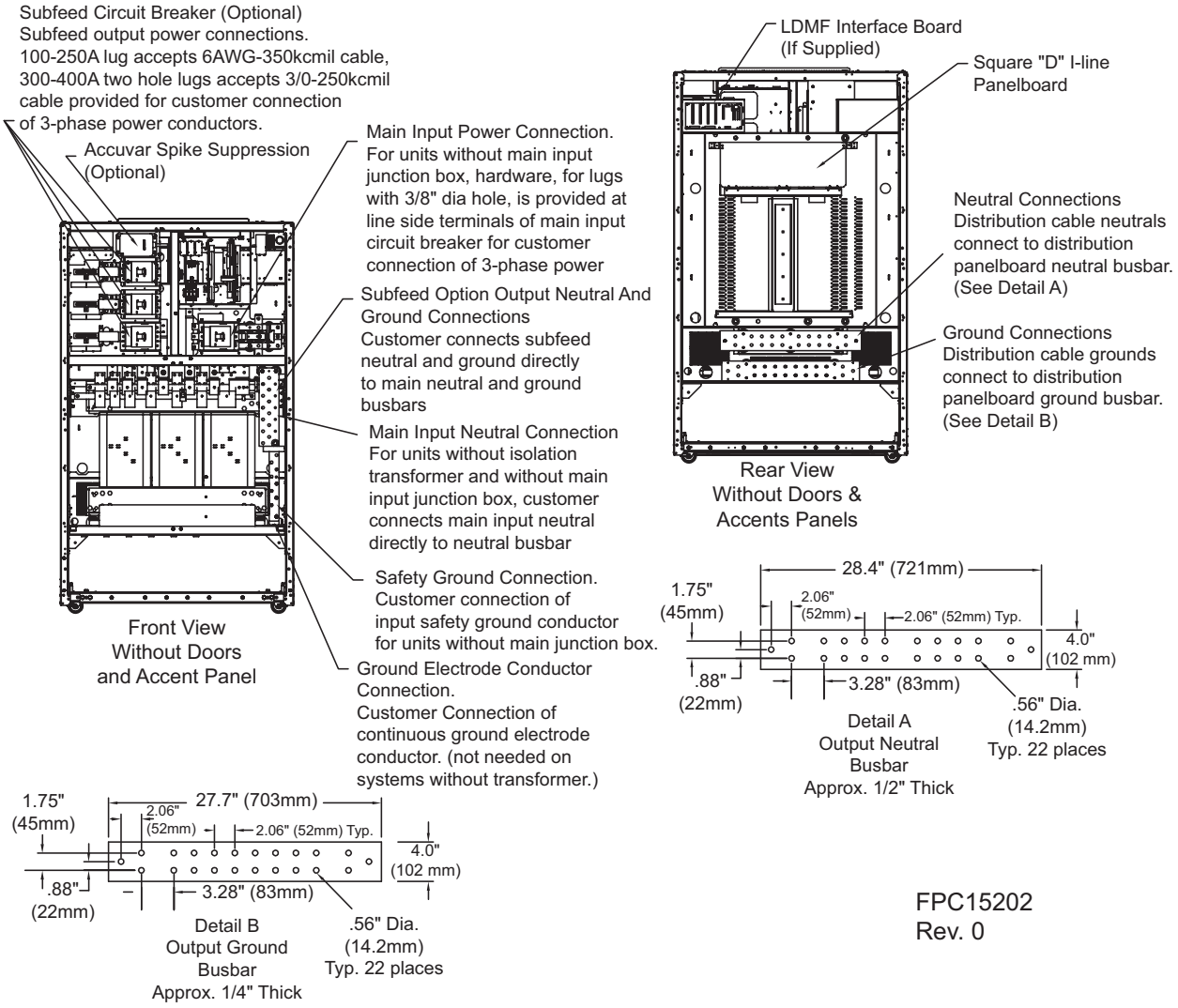
## Figure 5 Electrical connection location for 23" (584mm) cabinet




## Figure 6 Electrical connection location for 47" (1194mm) cabinet



## Figure 7 Electrical connection location for 47" cabinet with Square D I-Line panelboard




FPC15202
Rev. 0

**Table 4 Suggested minimum input wire size data**

| kVA | Input Voltage | Units with Transformers | | | Transformerless Units | | |
|---|---|---|---|---|---|---|---|
| | | Input FLA | Input OPD | Suggested Feeder Wire Size (AWG) | Full Load Amps | MIB Trip Amps | Suggested Feeder Wire Size (AWG) |
| 15 | 208 | 43 | 60 | #6 AWG | 42 | 60 | #6 AWG |
| | 240 | 38 | 50 | #8 AWG | - | - | - |
| | 380 | 24 | 30 | #10 AWG | 23 | 30 | #10 AWG |
| | 400 | 23 | 30 | #10 AWG | 22 | 30 | #10 AWG |
| | 415 | 22 | 30 | #10 AWG | 21 | 30 | #10 AWG |
| | 480 | 19 | 25 | #10 AWG | - | - | - |
| | 600 | 15 | 20 | #12 AWG | - | - | - |
| 30 | 208 | 87 | 110 | #2 AWG | 83 | 110 | #2 AWG |
| | 240 | 75 | 100 | #2 AWG | - | - | - |
| | 380 | 48 | 60 | #6 AWG | 46 | 60 | #6 AWG |
| | 400 | 45 | 60 | #6 AWG | 43 | 60 | #6 AWG |
| | 415 | 44 | 60 | #6 AWG | 42 | 60 | #6 AWG |
| | 480 | 38 | 50 | #8 AWG | - | - | - |
| | 600 | 30 | 40 | #8 AWG | - | - | - |
| 50 | 208 | 145 | 200 | #3/0 AWG | 139 | 175 | #2/0 AWG |
| | 240 | 125 | 175 | #2/0 AWG | - | - | - |
| | 380 | 79 | 100 | #2 AWG | 76 | 100 | #2 AWG |
| | 400 | 75 | 100 | #2 AWG | 72 | 90 | #2 AWG |
| | 415 | 72 | 90 | #2 AWG | 70 | 90 | #2 AWG |
| | 480 | 63 | 80 | #4 AWG | - | - | - |
| | 600 | 50 | 70 | #4 AWG | - | - | - |
| 75 | 208 | 215 | 300 | 350 kcmil | 208 | 300 | 350 kcmil |
| | 240 | 186 | 250 | 250 kcmil | - | - | - |
| | 380 | 118 | 150 | #1/0 AWG | 114 | 150 | #1/0 AWG |
| | 400 | 112 | 150 | #1/0 AWG | 108 | 150 | #1/0 AWG |
| | 415 | 108 | 150 | #1/0 AWG | 104 | 150 | #1/0 AWG |
| | 480 | 93 | 125 | #1 AWG | - | - | - |
| | 600 | 74 | 100 | #2 AWG | - | - | - |
| 100 | 208 | 286 | 400 | (2) #3/0 AWG * | 278 | 350 | (2) #2/0 AWG * |
| | 240 | 248 | 350 | (2) #2/0 AWG * | - | - | - |
| | 380 | 157 | 200 | #3/0 AWG | 152 | 200 | #3/0 AWG |
| | 400 | 149 | 200 | #3/0 AWG | 144 | 200 | #3/0 AWG |
| | 415 | 143 | 200 | #3/0 AWG | 139 | 175 | #2/0 AWG |
| | 480 | 124 | 175 | #2/0 AWG | - | - | - |
| | 600 | 99 | 125 | #1 AWG | - | - | - |
| 125 | 208 | 358 | 450 | (2) #4/0 AWG * | 347 | 450 | (2) #4/0 AWG * |
| | 240 | 310 | 400 | (2) #3/0 AWG * | - | - | - |
| | 380 | 196 | 250 | 250 kcmil | 190 | 250 | 250 kcmil |
| | 400 | 186 | 250 | 250 kcmil | 180 | 225 | #4/0 AWG |
| | 415 | 179 | 225 | #4/0 AWG | 174 | 225 | #4/0 AWG |
| | 480 | 155 | 200 | #3/0 AWG | - | - | - |
| | 600 | 124 | 175 | #2/0 AWG | - | - | - |

**Table 4 Suggested minimum input wire size data (continued)**

| kVA | Input Voltage | Units with Transformers | | | Transformerless Units | | |
|---|---|---|---|---|---|---|---|
| | | Input FLA | Input OPD | Suggested Feeder Wire Size (AWG) | Full Load Amps | MIB Trip Amps | Suggested Feeder Wire Size (AWG) |
| 150 | 208 | 427 | 600 | (2) 350 kcmil * | 416 | 600 | (2) 350 kcmil * |
| | 240 | 370 | 500 | (2) 250 kcmil * | - | - | - |
| | 380 | 234 | 300 | 350 kcmil | 228 | 300 | 350 kcmil |
| | 400 | 223 | 300 | 350 kcmil | 217 | 300 | 350 kcmil |
| | 415 | 215 | 300 | 350 kcmil | 209 | 300 | 350 kcmil |
| | 480 | 185 | 250 | 250 kcmil | - | - | - |
| | 600 | 148 | 200 | #3/0 AWG | - | - | - |
| 200 | 380 | 312 | 400 | (2) #3/0 AWG * | 304 | 400 | (2) #3/0 AWG * |
| | 400 | 297 | 400 | (2) #3/0 AWG * | 289 | 400 | (2) #3/0 AWG * |
| | 415 | 286 | 400 | (2) #3/0 AWG * | 278 | 350 | (2) #2/0 AWG * |
| | 480 | 247 | 350 | (2) #2/0 AWG * | - | - | - |
| | 600 | 197 | 250 | 250 kcmil | - | - | - |
| 225 | 380 | 352 | 450 | (2) #4/0 AWG * | 342 | 450 | (2) #4/0 AWG * |
| | 400 | 334 | 450 | (2) #4/0 AWG * | 325 | 450 | (2) #4/0 AWG * |
| | 415 | 322 | 450 | (2) #4/0 AWG * | 313 | 400 | (2) #3/0 AWG * |
| | 480 | 278 | 350 | (2) #2/0 AWG * | - | - | - |
| | 600 | 222 | 300 | 350 kcmil | - | - | - |
| 300 | 380 | 469 | 600 | (2) 350 kcmil * | 456 | 600 | (2) 350 kcmil * |
| | 400 | 446 | 600 | (2) 350 kcmil * | 433 | 600 | (2) 350 kcmil * |
| | 415 | 430 | 600 | (2) 350 kcmil * | 417 | 600 | (2) 350 kcmil * |
| | 480 | 372 | 500 | (2) 250 kcmil * | - | - | - |
| | 600 | 297 | 400 | (2) #3/0 AWG * | - | - | - |

* Parallel feeders per NEC 300-20 and 310-4

FLA = Full Load Amps of Power Center

OPD = Overcurrent Protection Device inside the Liebert® FPC™

Wire sizes based on NEC Table 310-16, using 75°C copper conductor

1. Main input power feeder should be a dedicated feeder direct from service entrance or other power source possible
2. Ground conductors recommended to be insulated conductors run with power conductors for increased system performance. Ground conductor minimum size per NEC Table 250-66. Input power feeder conduit may be used as the safety ground conductor. When conduit is used, adequate electrical continuity must be maintained at conduit connections to enclosures and throughout conduit run.
3. Input feeder wire size listed in this table is the minimum feeder size recommended. Larger wire size may be required because of voltage drop or supply overcurrent protection device.
4. For transformerless units with 3-phase 4W + G input feeder larger wire size may be required because of excessive neutral current (see NEC Table 310-15 note 4: For best performance, the unit should be located as close to load as practical.

**Table 5 Main input circuit breaker interrupting rating**

| Standard interrupting rating* | | | |
|---|---|---|---|
| **208V** | **480V** | **380-415V** | **600V** |
| 100 kA | 35 kA | 35 kA | 25 kA |

* Refer to unit specification sheet for units equipped with non-standard main input breakers.

### 1.3.2 Junction Box Installation

Main input (power) and low-voltage (control) junction boxes are available for the Liebert® FPC™ to simplify customer connections.

The junction boxes, if used, can either be shipped with the system or can be advance-shipped for installation during the roughing-in stage of new construction.

Liebert supplies flexible, 10-foot-long (3m) conduit with cables for connecting the junction boxes to the unit. The junction boxes should be installed a maximum of 8 ft. (2.4m) from the feeder entrance of the unit.

Liebert recommends centering the junction boxes under a floor tile that is easily removed.

Junction box connections must be installed in compliance with the NEC and all other applicable codes.

**WARNING**

Risk of electric shock and arc flash. Can cause injury and death.

Verify that incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making any connections in the junction box.

Typical junction box connections are shown in **Figure 14** and described in **1.3 - Power and Control Wiring**.

**Table 6 Main input junction box electrical connections (4 wire)**

| Junction Box Size Inches (mm) | Electrical Connections |
|---|---|
| 27 x 14 x 6 (686 x 356 x 152) | 400A 3 pole power block with 1/2 -13 studs on 1-3/4" (44mm) centers<br>750A ground busbar with two sets of 3/8 - 16 studs on 1.75” centers |
| 35 x 22 x 6 (889 x 559 x 152) | 750A phase busbars with 1/2 -13 studs on 1-3/4" (44mm) centers<br>750A ground busbar with two sets of 3/8 - 16 studs on 1-3/4" (44mm) centers |

**Table 7 Main input junction box without transformer electrical connections (5 wire)**

| Junction Box Size Inches (mm) | Electrical Connections |
|---|---|
| 27 x 14 x 6 (686 x 356 x 152) | 400A 3 pole power block with 1/2 -13 studs on 1-3/4" (44mm) centers<br>750A neutral busbar with two sets of 1/2 - 13 studs on 1-3/4" (44mm) centers<br>750A ground busbar with two sets of 3/8 - 16 studs on 1-3/4" (44mm) centers |
| 35 x 22 x 6 (889 x 559 x 152) | 750A phase busbars with 1/2 -13 studs on 1.75” centers<br>1500A neutral busbar with two sets of 1/2 - 13 studs on 1-3/4" (44mm) centers<br>750A ground busbar with two sets of 3/8 - 16 studs on 1-3/4" (44mm) centers |

Dimensions are given on the drawings furnished with the unit. Typical dimensions of the junction boxes are as follows:

**Table 8 Low-voltage (control) junction box dimensions, typical**

| | |
|---|---|
| Width, inches (mm) | 8 (203) |
| Length, inches (mm) | 10 (254) |
| Height, inches (mm) | 4 (102) |

**Table 9 Main input (power) junction box dimensions, typical**

| Unit kVa | Input Voltage | | |
|---|---|---|---|
| | 208-240V | 380-415V | 480-600V |
| 15-100 kVA, L x W x H, inches (mm) | 27 x 14 x 6 (686 x 356 x (152) | | |
| 125-150 kVA, L x W x H, inches (mm) | 35 x 22 x 6 (889 x 559 x 152) | 27 x 14 x 6 (686 x 356 x (152) | |
| 200 kVA, L x W x H, inches (mm) | N/A | 27 x 14 x 6 (686 x 356 x (152) | |
| 225 kVA, L x W x H, inches (mm) | N/A | 35 x 22 x 6 (889 x 559 x 152) | 27 x 14 x 6 (686 x 356 x (152) |
| 300 kVA, L x W x H, inches (mm) | N/A | 35 x 22 x 6 (889 x 559 x 152) | |

**Figure 8 Low-voltage control junction box connections, typical**

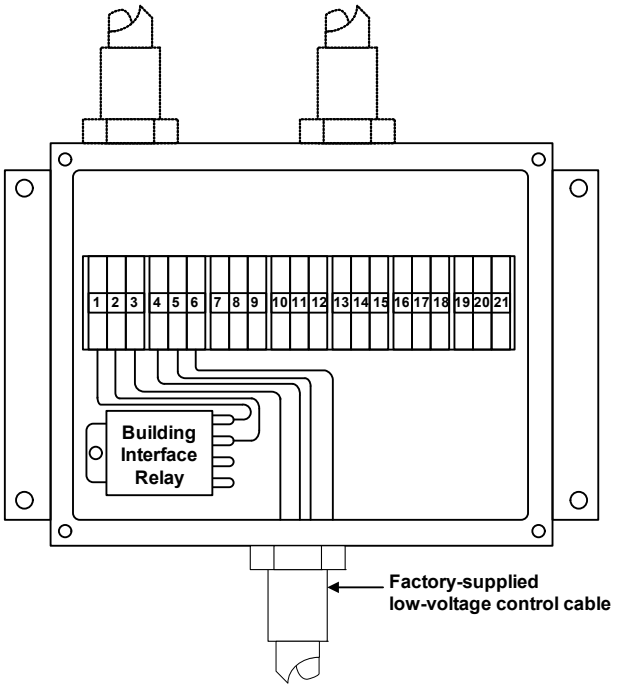
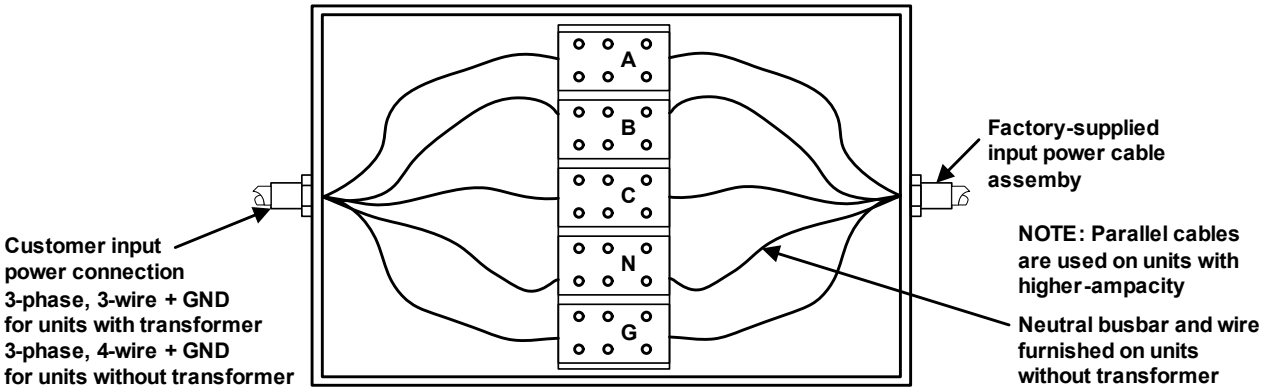



**Figure 9 Main input junction box connections, typical**


A
B
C
N
G
Factory-supplied input power cable assemby
NOTE: Parallel cables are used on units with higher-ampacity
Neutral busbar and wire furnished on units without transformer
Customer input power connection
3-phase, 3-wire + GND for units with transformer
3-phase, 4-wire + GND for units without transformer

## 1.3.3 System Grounding

The performance and safety of any power conditioning system depend on proper grounding. **Figure 10** shows the typical grounding arrangements for the Liebert® FPC™.

### Equipment Grounding

Equipment grounding is primarily for safety. Correct implementation of grounding also enhances equipment performance. All power feeders must include equipment grounding means as required by the NEC and local codes.

An insulated ground conductor is recommended to be run in each feeder conduit. Ground conductors must be at least the minimum size per NEC Table 250-66. Larger wire sizes may be used for increased system performance.

If the input power feeder conduit is used as a grounding conductor, adequate electrical continuity must be maintained at all conduit connections.

**WARNING**

Risk of electric shock. Can cause equipment damage, improper operation, injury and death.

Isolating bushings must not be used in a metal conduit run. These busings might prevent the system from being properly grounded.

### Signal Reference Grid

If the unit is used to supply power to a computer room or area that is equipped with a signal reference grid or a grounded raised-floor stringer system, a grounding conductor should be connected from the system ground bus to the grid or floor system. This conductor should be stranded or braided #8 AWG or larger, and as short as practical. Less than 3 ft. (1m) is recommended.

## 1.3.4 Grounding Electrode Conductor for Liebert® FPCs With Transformer

**Required by code** - The Liebert FPC™ with transformer must be grounded according to the safety practices of NEC 250-26. A local grounding electrode conductor is recommended in addition to the equipment safety ground which is normally run with the input power conductors. (See **Figures 5** through **7**.)

As shown in **Figure 10**, the grounding electrode conductor is run from the unit to the nearest effectively grounded location (listed in order of preference):

- Building steel
- Metal water pipe
- Other made grounding electrode

The grounding electrode conductor's size is based on the secondary circuit conductors. **Table 10** shows the minimum recommended grounding electrode conductor according to the NEC (Table 250-66).

**Table 10 Minimum grounding electrode conductor size (AWG)**

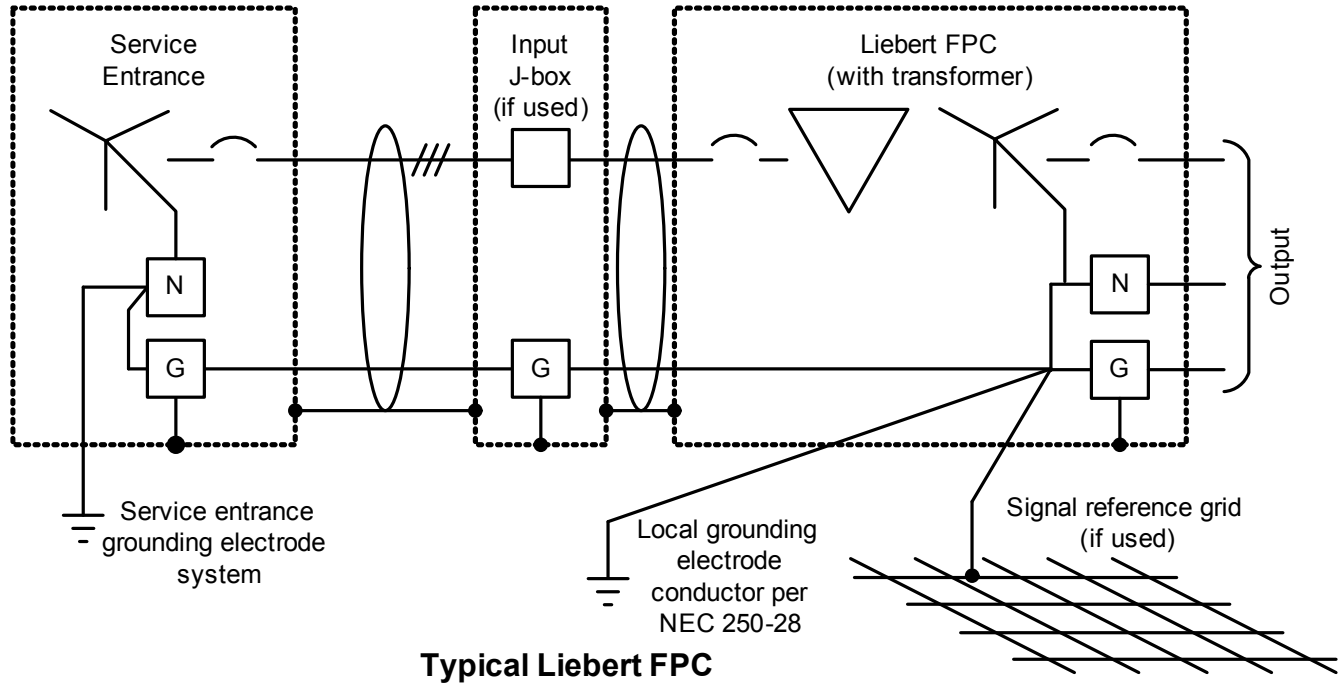
| | Output Voltage | | |
|---|---|---|---|
| kVA | 208V | 380V | 415V |
| 15 | 8 | 8 | 8 |
| 30 | 8 | 8 | 8 |
| 50 | 4 | 8 | 8 |
| 75 | 2 | 6 | 6 |
| 100 | 0 | 4 | 4 |
| 125 | 0 | 2 | 2 |
| 150 | 00 | 2 | 2 |
| 200 | 00 | 0 | 0 |
| 225 | 00 | 0 | 0 |
| 300 | 00 | 0 | 0 |

AWG wire size based on 75°C copper conductors

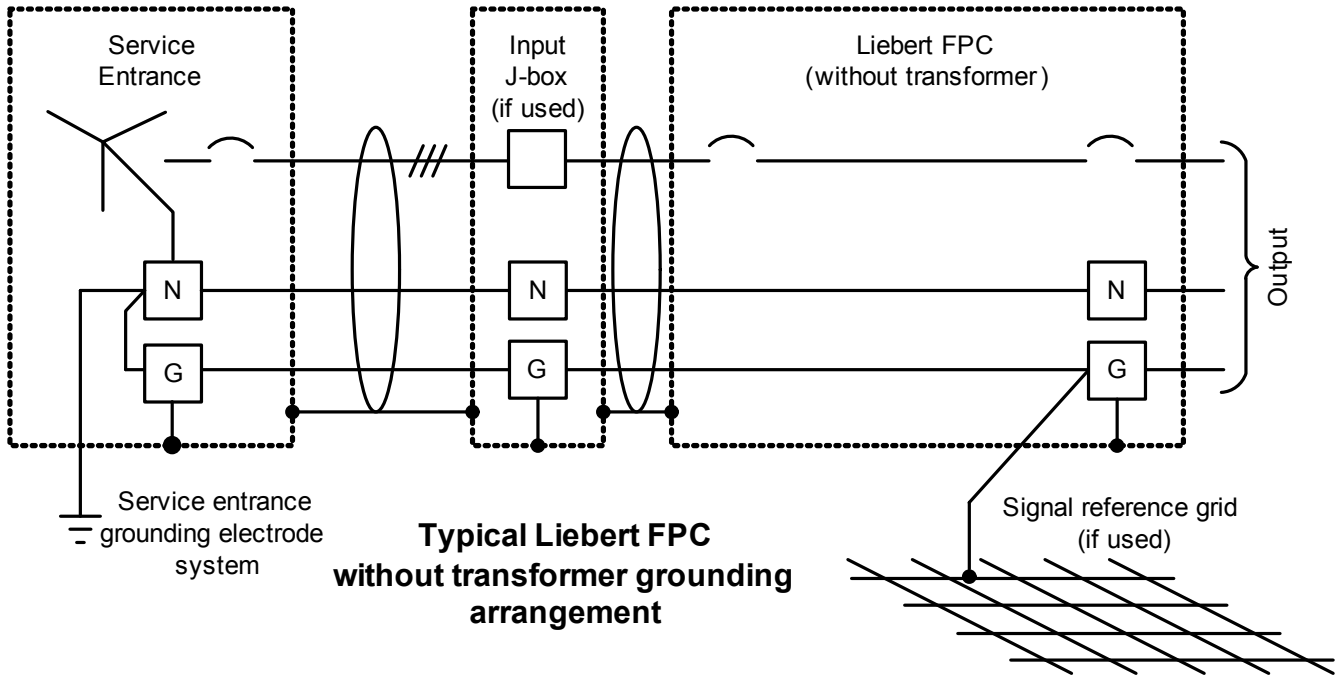
Recommended methods for running the grounding electrode conductor (arranged by preference for system performance; as acceptable by local and other applicable codes):

- Outside of conduit (where not subject to damage)
- Inside non-metallic conduit
- Inside non-ferrous conduit
- Inside ferrous conduit, bonded to the ferrous conduit at both ends, as acceptable by local and other applicable codes

**Figure 10 Typical grounding arrangements**




**Typical Liebert FPC with transformer grounding arrangement**




**Typical Liebert FPC without transformer grounding arrangement**

### 1.3.5 Output Power Connections

Output circuit breaker(s) and/or panelboards with ground and neutral provisions are provided inside the unit for connecting load(s) as required. (See **Figures 5** through **7**.)

Flexible output distribution cables for use in data processing areas under a raised floor are optional and may be factory-supplied. Cable lengths and layout should be well-planned:

- **Cable access**—Cable routes should follow aisles between equipment. This will facilitate access to cables for installation, routine inspection and alterations.
- **Cable length**—Measure the distance to the load equipment following right-angle paths, rather than diagonally or directly. Always measure to the extreme far side of the equipment with respect to the unit to ensure adequate cable length.
- **Air circulation**—Prevent restriction of airflow under the raised floor by running the flexible conduits flat on the subfloor, in parallel paths.

For best performance, the Liebert® FPC™ should be installed as close as practical to the load.

Initial system output loading should be between 50% and 75% of rated capacity. This allows the addition of loads without immediately investing in another power conditioner. The high partial-load efficiency of the Liebert FPC permits such sizing without imposing an energy-use penalty during initial operation.

Balancing of loads is good design practice on any 3-phase system. Accordingly, each distribution panel is load-balanced at the factory, based on output branch circuit breaker sizes. All additions to the system should be arranged so as to preserve this balance.

**WARNING**

Risk of electric shock and arc flash. Can cause injury and death.

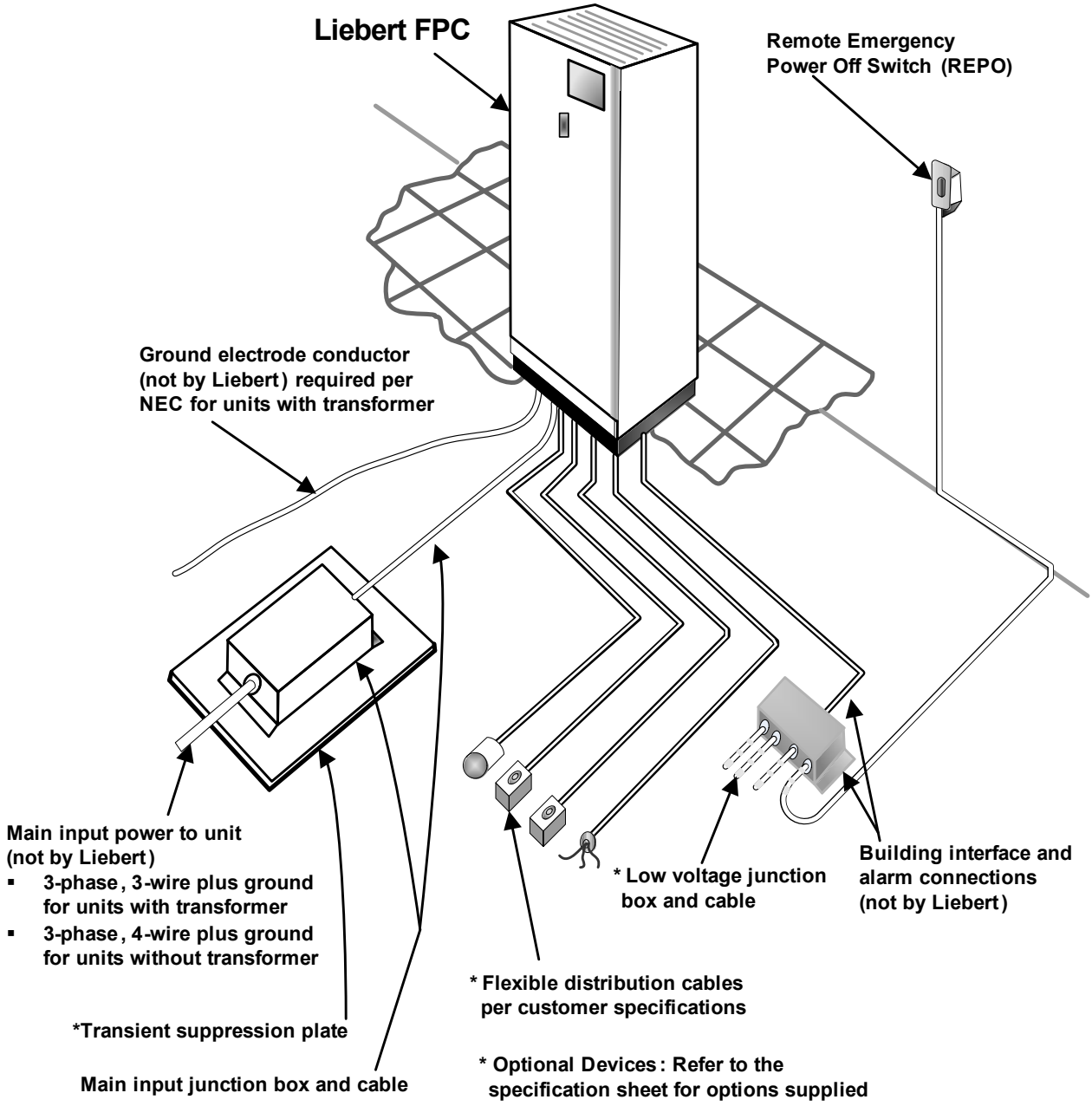
Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or output breakers or making connections, whether in the junction box or in the unit.

Verify that incoming line voltage circuits are de-energized and locked out before installing output breakers and cables.

**Code Compliance**—All output cables and connections must comply with the NEC and all other applicable codes.

**Padlock-Off Provisions**—All output cables without receptacles that are hard-wired to the load equipment must be equipped with a padlock-off accessory for the output circuit breaker. The padlock-off accessory is to be used to lock-out and tag the circuit breaker when service is performed on the hard-wired load equipment in accordance with OSHA safety rules.

**Figure 11 Typical Liebert® FPC™ equipment arrangement**


Liebert FPC
Remote Emergency Power Off Switch (REPO)
Ground electrode conductor (not by Liebert) required per NEC for units with transformer
Main input power to unit (not by Liebert)
▪ 3-phase, 3-wire plus ground for units with transformer
▪ 3-phase, 4-wire plus ground for units without transformer
*Transient suppression plate
Main input junction box and cable
* Flexible distribution cables per customer specifications
* Low voltage junction box and cable
Building interface and alarm connections (not by Liebert)
* Optional Devices: Refer to the specification sheet for options supplied

### 1.3.6 Control Wiring Connections

Liebert® power conditioning systems have provisions for external shutdown control from Remote Emergency Power Off (REPO) stations. **Figure 12** is a simplified diagram of the shutdown circuitry of the Liebert FPC™.

#### Low-Voltage Control Circuit

Control wiring connections must comply with the NEC and all other applicable codes.

**WARNING**

Risk of electric shock and arc flash. Can cause injury and death.

Verify that all incoming high-voltage (power) and low-voltage (control) circuits are de-energized and locked out before installing cables or making connections, whether in the junction box or in the unit.

As shown in **Figure 12**, the control circuit operates on 24VDC. The shutdown device (represented by the REPO switch) activates a low-current, 24VDC relay that in turn operates the shunt-trip mechanism. The shunt-trip solenoid opens the Main Input Breaker, which de-energizes the power center.

#### Multiple-Unit Shutdown

When more than one power center is installed by the user, a typical requirement is that actuation of a single device (REPO for example) must shut down all power centers. The low-voltage control circuits of all standard Liebert FPC systems are designed to meet this requirement.

#### External Control Wiring Connections

External control wiring connections for remote shutdown, alarm, and/or monitoring are made to the low-voltage junction box (if used) or to the adapter board terminal strip located inside the unit.

Control wiring connections vary with the type of monitoring system furnished with the unit. Typical control wiring configurations are shown in **Figures 12** through **15**.

**Figure 12 Simplified shutdown circuit**

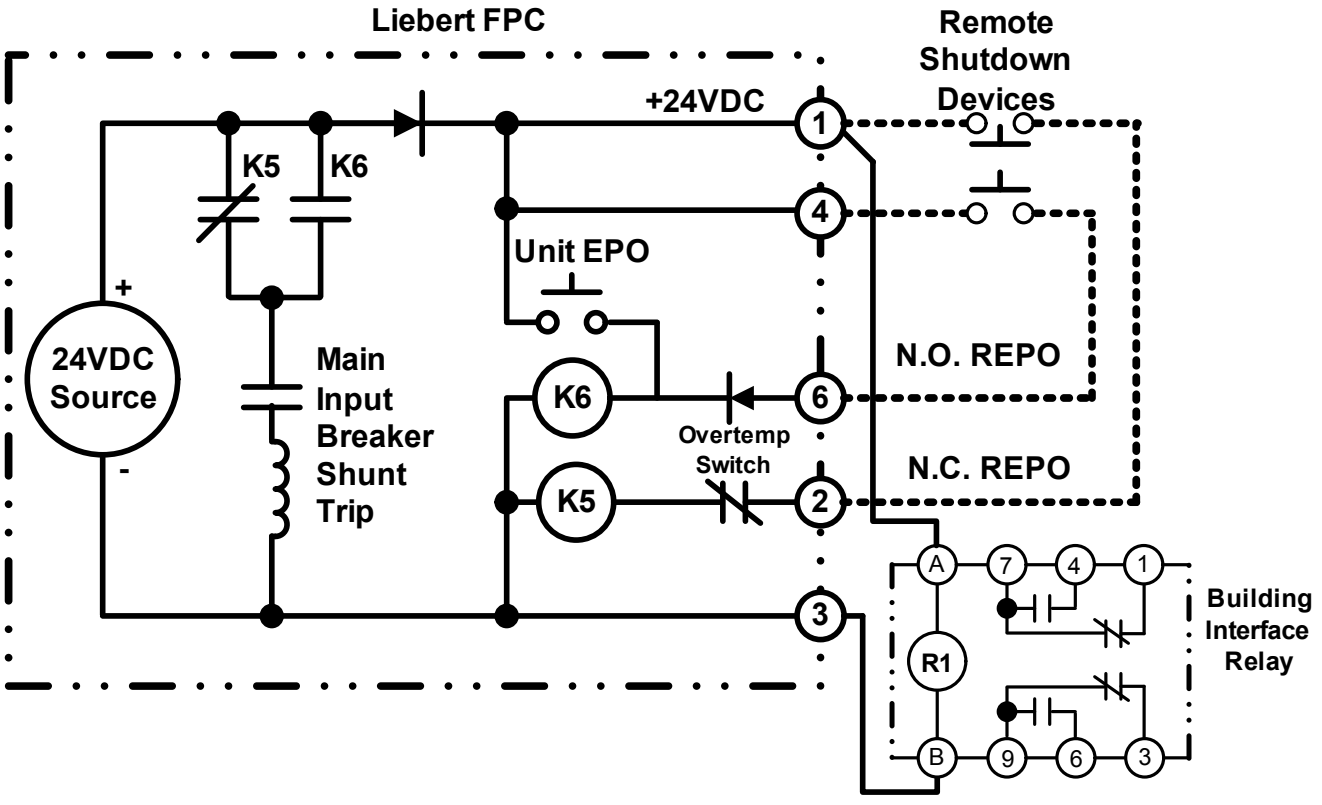
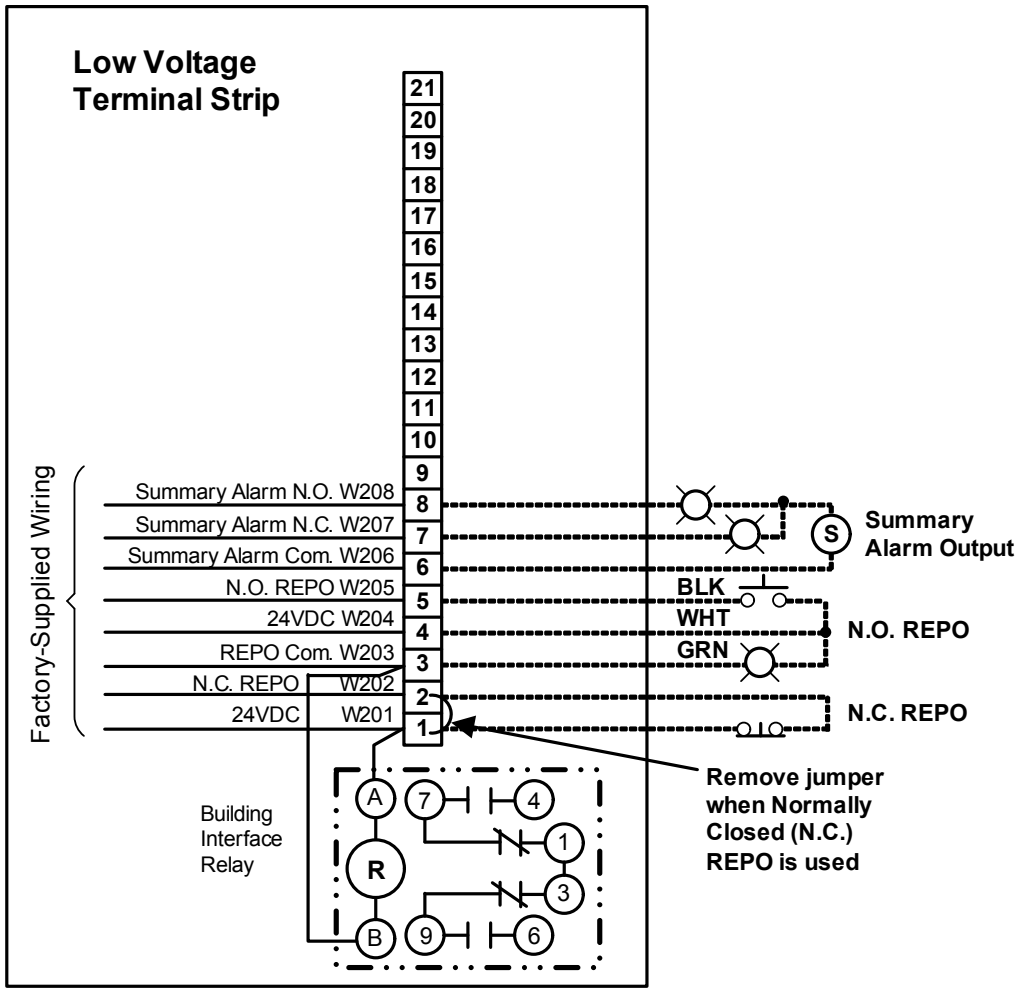


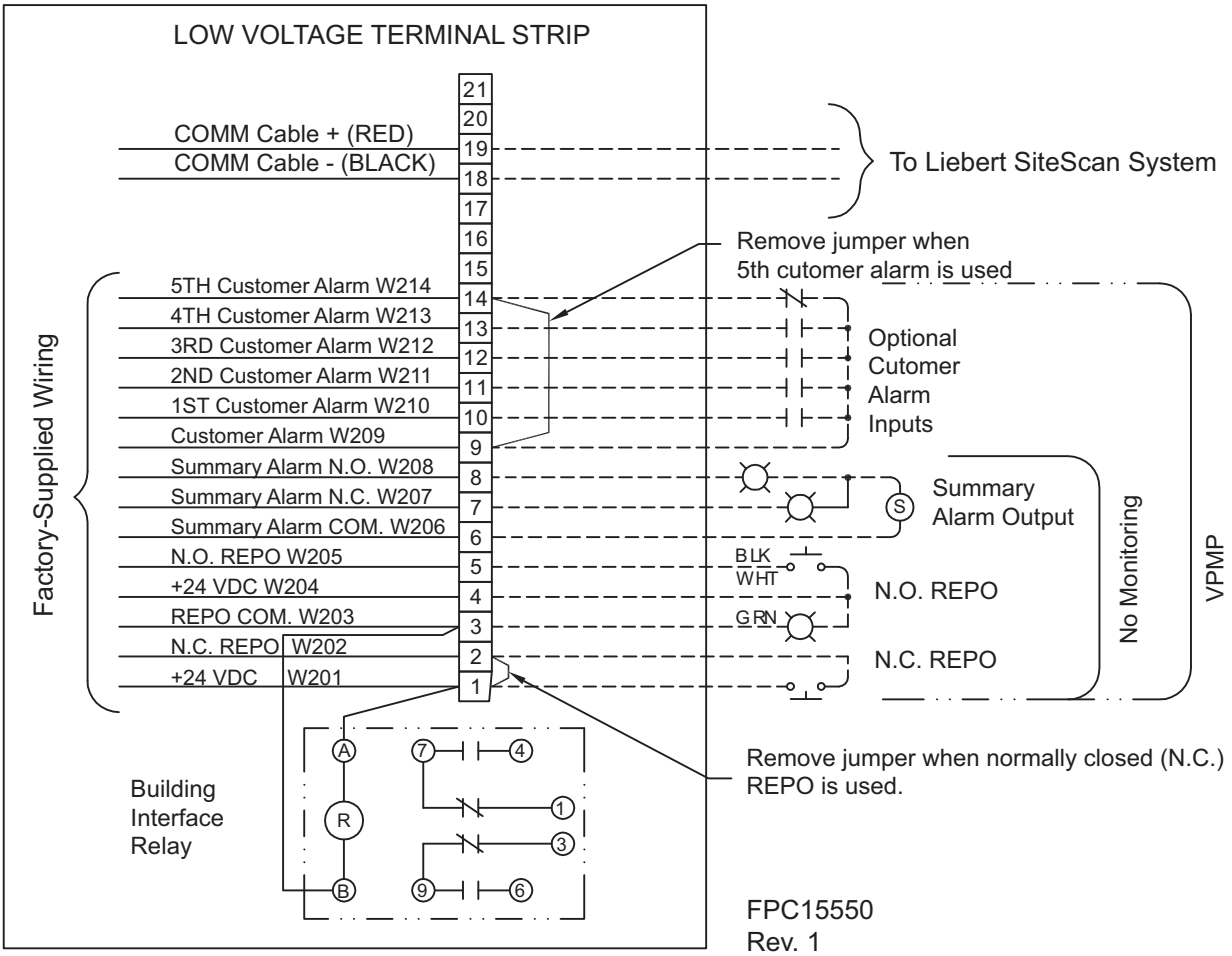
**Figure 13 Typical low-voltage junction box (if used) control wiring for units without monitoring**




**NOTES**

1. All switching devices are to be suitable for switching low current 24VDC. Minimum recommended wire size is 18AWG stranded copper with 300V insulation.
   All wiring and devices are field supplied except where noted. See installation manual for detailed installation procedures.
2. Low voltages terminal strip located in the low-voltage control junction box.
3. The total load on the 24VDC supply (both N.O. and N.C. REPO circuits) must be limited to 1A.
4. Multiple normally open (N.O.) REPO switches may be paralleled.
   Multiple normally closed (N.C.) REPO switches may be connected in series. all lamps (if used) are connected in parallel.
5. The summary alarm contacts are rated for 0 to 30VAC or VDC, 0.5A, 10W maximum.

**Figure 14 Typical low-voltage junction box (if used) control wiring for units with monitoring**



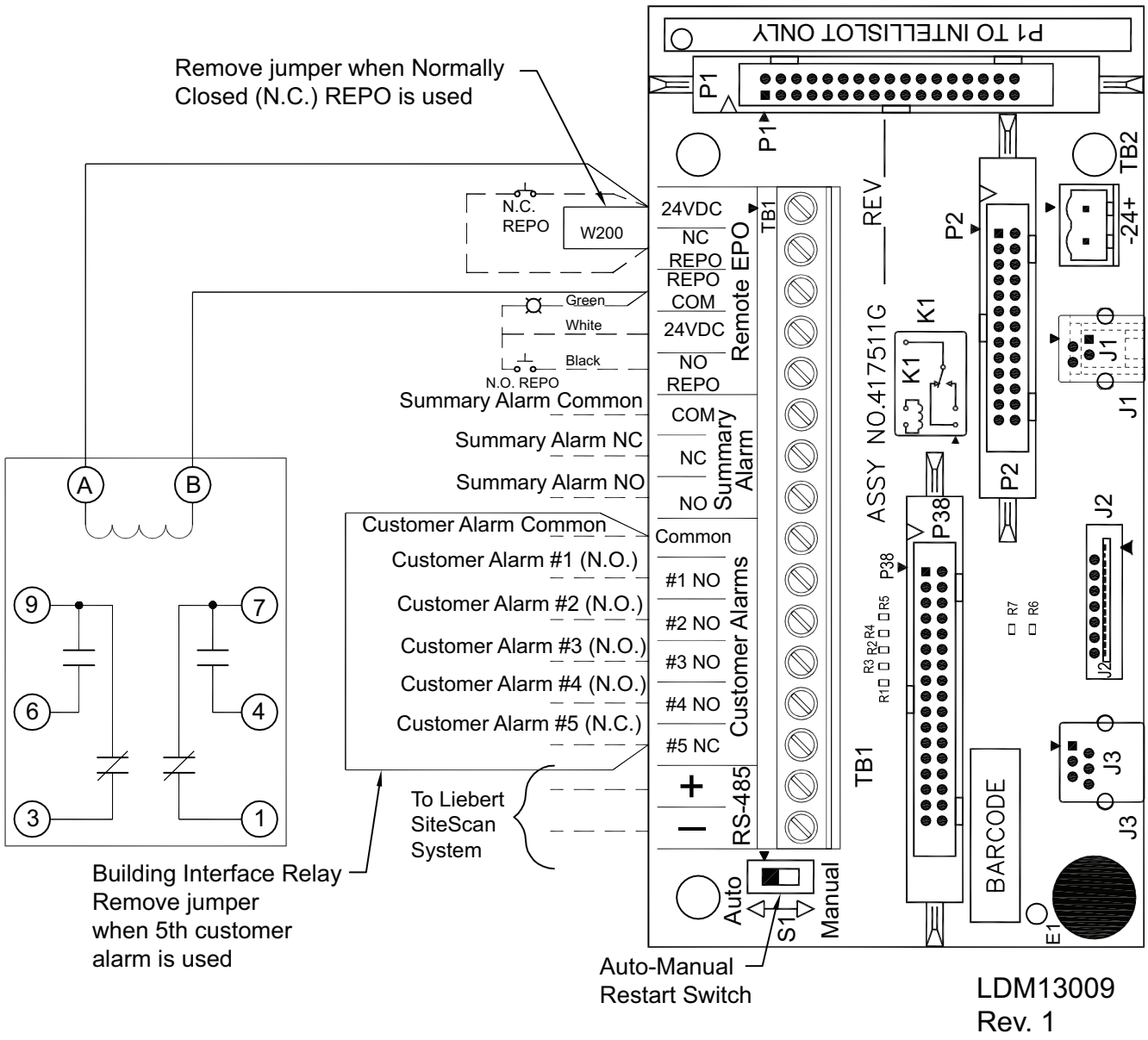

**NOTES**

1. All switching devices are to be suitable for switching low current 24VDC. Minimum recommended wire size is 18AWG stranded copper with 300V insulation.

   All wiring and devices are field-supplied except where noted. See installation manual for detailed installation procedures.
2. Low voltages terminal located in the low-voltage control junction box.
3. The total load on the 24VDC supply (both N.O. and N.C. REPO circuits) must be limited to 1A.
4. Multiple normally open (N.O.) REPO switches may be paralleled.

   Multiple normally closed (N.C.) REPO switches may be connected in series. All lamps (if used) are connected in parallel.
5. The summary alarm contacts are rated for 0 to 30VAC or VDC, 0.5A, 10W maximum.
6. Customer alarms 1 through 4 are normally open (indicates alarm on contact closure). Customer alarm 5 is normally closed (indicates alarm on contact opening).
7. For Liebert SiteScan connection, use #22 AWG shielded cable maximum distance 1000ft (300m).

**Figure 15 Control wiring for units without low-voltage control box**




**NOTES**

1. All switching devices are to be suitable for switching low current 24VDC. Minimum recommended wire size is 18AWG stranded copper with 300V insulation.
   All wiring and devices are field-supplied except where noted. See installation manual for detailed installation procedures.
2. The total load on the 24VDC supply (both N.O. and N.C. REPO circuits) must be limited to 1A.
3. Multiple normally open (N.O.) REPO switches may be paralleled.
   Multiple normally closed (N.C.) REPO switches may be connected in series. All lamps (if used) are connected in parallel.
4. The summary alarm contacts are rated for 0 to 30VAC or VDC, 0.5A, 10W maximum.
5. Customer alarms 1 through 4 are normally open (indicates alarm on contact closure). Customer alarm 5 is normally closed (indicates alarm on contact opening).
6. For Liebert SiteScan connection, use #22 AWG shielded cable maximum distance 1000ft (300m).

### 1.3.7 Adapter Board

The Adapter Board (AB) provides customer interface to the Liebert® FPC™ monitoring systems for units without Low-Voltage Junction Box. Connections are made to terminal strip TB1 for Remote Emergency Power Off (REPO) switches, summary alarm contacts and customer alarms (VPMP monitoring). The AB is mounted on top of the monitoring enclosure located inside the top right corner of the unit.

A field-selectable switch (S1) on the AB allows the VPMP to be set up for either Manual or Auto restart. The factory default setting is **Manual**.

- **Manual Restart** allows for an orderly supervised startup after power failure. The control circuit automatically energizes the shunt trip mechanism of the main input breaker upon sensing output voltage failure.
- **Auto Restart** deactivates the manual restart function. In Auto Restart mode, the main input breaker does not trip due to power failure and the unit will restart when power is restored.

If two Liebert LDMF systems are provided, the summary alarm contacts from each Liebert LDMF are tied to the Customer Summary Alarm on the adapter board.

# 2.0 EQUIPMENT INSPECTION AND STARTUP

## 2.1 Internal Inspection

**A detailed internal inspection** should be performed after the unit is in place and before it is energized, to ensure trouble-free startup. The same internal inspection should be carried out when performing preventive maintenance.

**WARNING**

Risk of electric shock and arc flash. Can cause injury and death.

Verify that all incoming line voltage (power) and low-voltage (control) circuits are de-energized and locked out before performing the internal inspection.

**Open the unit** - Gain access to the internal components of the Liebert® FPC™ unit by removing the exterior panels and internal accent panels.

**Visually inspect** - Be sure wiring and components are not damaged.

**Check power connections** - Check **all** power connections for tightness. Refer to **Tables 11** through **14** for torque requirements of all electrical connections.

**Perform formal detailed inspection** - Follow the procedures described in **3.0 - Inspection and Startup Checklist** when performing detailed inspection.

## 2.2 Startup

### Checklists

Follow the detailed step-by-step checklist (**3.0 - Inspection and Startup Checklist**) when installing and starting up the Liebert FPC.

### Initial System Startup

A qualified electrician must be employed to perform the equipment inspection and startup. Liebert system startup may be arranged by calling your local Emerson sales representative or Emerson Network Power Liebert Services. In the United States, call 1-800-LIEBERT.

### Warranty

A copy of the appropriate checklist (furnished with the equipment) must be completed, signed, dated and returned to Emerson Network Power. Warranty coverage of the equipment is not effective unless the checklist has been received by the factory.

**WARNING**

Risk of improper startup. Can cause equipment damage, personal injury and death.

Hazardous voltages are present during startup procedures. Electrical safety precautions must be followed throughout inspection and startup.

Equipment inspection and startup should be performed only by properly trained and qualified personnel wearing appropriate safety headgear, gloves and shoes.

**Table 11 Torque specifications, general**

| | Electrical connections with 1 Belleville washer | | Electrical connections with 2 Belleville washers | |
|---|---|---|---|---|
| | Torque | | Torque | |
| | lb-in | N-m | lb-in | N-m |
| Bolt shaft size, in./mm | | | | |
| 1/4 / M6 | 40 | 4.5 | 80 | 9.0 |
| 5/16 / M8 | 80 | 9.0 | 160 | 18.0 |
| 3/8 / M10 | 120 | 13.6 | 240 | 27.1 |
| 1/2 / M12 | 240 | 27.1 | 480 | 54.2 |
| Input and output breakers | | | | |
| Up to 150 amp | 80 | 9.0 | 160 | 18.0 |
| 175 - 500A | 120 | 13.6 | 240 | 27.1 |

**Table 12 Panelboard main circuit breaker torque specifications**

| | Torque | |
|---|---|---|
| | lb-in | N-m |
| Busbar-to-breaker | 240 | 27.1 |

**Table 13 Branch circuit breaker torque specifications**

| Breaker size | lb-in | N-m |
|---|---|---|
| Up to 30 amp | 20 | 4.0 |
| 40 to 100 amp | 20 | 5.1 |

**Table 14 Terminal block compression lug torque specifications**

| AWG wire size or range | Torque | |
|---|---|---|
| | lb-in | N-m |
| #14 - #10 | 35 | 4.0 |
| #8 | 40 | 4.5 |

# 3.0 INSPECTION AND STARTUP CHECKLIST

**Unit Serial Number** _____

**Unit Model Number** _____

**Date** _____

## 3.1 Inspection

**WARNING**

Risk of electric shock and arc flash. Can cause injury and death.

All equipment inspection procedures are to be performed with power to the unit turned Off and locked out.

___ 1. Confirm that the exterior of unit is undamaged (including cables and receptacles, if furnished).

___ 2. Confirm that service and ventilation clearances are adequate. (See **Figures 1** through **3**.)

___ 3. Remove accessible exterior and internal panels.

___ 4. Inspect all wire and conductor insulation for damage.

___ 5. Check all transformer terminal connections for tightness. Retorque if necessary.

___ 6. Check all breaker connections for tightness. Retorque if necessary.

___ 7. Check all terminal block connections for tightness. Retorque if necessary.

___ 8. Check transformer mounting bolts for tightness. Retorque if necessary.

___ 9. Remove any foreign objects from the components or the interior area of the unit. Make sure air passages on transformers are clear and free of debris.

___ 10. Check that the intake and exhaust air screens are clean and free of obstructions.

___ 11. Replace internal and exterior side panels, leaving access to circuit breakers for the following startup procedure.

## 3.2 Startup

**WARNING**

Risk of electric shock and arc flash. Can cause injury and death.

Startup procedures should be performed only by properly trained and qualified personnel. Hazardous voltages are present in the equipment throughout the majority of the startup procedure. Use proper safety equipment. proceed with caution.

When opening the main input circuit breaker wait a minimum of one minute before reclosing.

1. Make certain that all circuit breakers are in the Off position and that power to the unit is locked out.

**NOTE**

***Steps 2** through **6** apply to the Main Input Junction Box. If this installation is not provided with a Main Input Junction Box, proceed to **Step 7**.*

___ 2. Remove the cover of the Main Input Junction Box. Verify proper input power connections to unit, including equipment grounding conductor.

___ 3. Turn On the building power to the junction box. Check the phase rotation at the junction box. Phase rotation should be A, B, C, as indicated.

___ 4. Check and record the input voltages at the junction box:
Volts, Phase A to Phase B = _____
Volts, Phase B to Phase C = _____
Volts, Phase C to Phase A = _____

___ 5. Turn Off and lock out the building power to the input junction box.

___ 6. Replace the junction box cover.

___ 7. Verify proper input power connections to unit, including equipment grounding conductor and local grounding electrode conductor.

___ 8. Turn On the building input power to the unit.

___ 9. Check the phase rotation at the main input breaker. Phase rotation should be A, B, C, left-to-right.

___ 10. Check and record the input voltage at the main input breaker. Measured voltages should correspond to the unit's nameplate input voltage.
Volts, Phase A to Phase B = _____
Volts, Phase B to Phase C = _____
Volts, Phase C to Phase A = _____

___ 11. Turn On the main input breaker; wait one minute. (If breaker trips Off, check for wiring errors including control connections. Contact Liebert™ Services or the location factory representative for assistance.)

___ 12. Check the phase rotation at the line side terminals (top) of the panelboard main breaker(s) and any subfeed output circuit breaker(s). The rotation should be A, B, C, left-to-right.

___ 13. Check and record the voltages at the line-side terminals of the output circuit breaker. Measured voltages should correspond to the unit's nameplate output voltage (within +4%,-0%).
Volts, Phase A to Phase B = _____
Volts, Phase B to Phase C = _____
Volts, Phase C to Phase A = _____
Volts, Phase A to Neutral = _____
Volts, Phase B to Neutral = _____
Volts, Phase C to Neutral = _____

If output voltage is incorrect, check for wiring errors, incorrect input voltage, or improper transformer tap. Contact Liebert Services at 1-800-LIEBERT in the United States or your local Emerson representative for assistance.

**NOTE**

*The Liebert® FPC™ transformer has input voltage taps for each input phase. The taps are arranged in 2-1/2% or 5% intervals ranging from -10% to nominal to +5%. This permits the transformer to provide the proper output voltage for a range of input voltages. Should it be necessary, the tap arrangement may be changed to match the input voltage:*

- *Open main input circuit breaker.*
- *Select tap arrangement to match input voltage. (Refer to transformer nameplate for tap information.)*
- *Secure each line to its proper tap.*
- *Repeat **Steps 11** to **13**.*

___ 14. Press the local Emergency Power Off switch, if supplied, and verify system shutdown. Turn the unit back on.

___ 15. Repeat **Step 14** for each remote Emergency Power Off switch with which the system is equipped.

# NOTICE

Risk of improper shutodwn. Can cause equipment damage.

The Remote Emergency Power Off switch may shut down more equipment or systems than just the Liebert FPC

## 3.3 Monitoring System Checklist

### Basic Indicators

___ 1. Turn On the building power to the unit, then turn the main input breaker On.

___ 2. Check that the Power LED on the front panel is illuminated.

### Manual Restart Check

If the Liebert® FPC™ is equipped with Manual Restart:

___ 1. Turn on building power to the Liebert FPC. Turn Main Input Breaker On.

___ 2. Turn off all building power to the Liebert FPC.

___ 3. Observe that Main Input Breaker automatically trips open upon power loss.

___ 4. Restore building power to the Liebert FPC and return Main Input Breaker to On.

### Power Monitor Panel

If the Liebert FPC is equipped with a Power Monitor Panel:

___ 1. Turn On the Liebert FPC.

___ 2. Ensure that the voltage values indicated by the Monitor Panel correspond to the voltage values measured at the input and output circuit breaker (**Steps 10** and **13** in **3.2 - Startup**).

### Centralized Monitor

If the Liebert FPC is connected to a Centralized Monitoring System:

___ 1. Turn On the Liebert FPC and the Centralized Monitoring System.

___ 2. Verify proper communication to the monitor system operation.

### Control Voltage

___ 1. Obtain access to the low-voltage terminals in the low-voltage junction box (if used), or the adapter board inside unit.

___ 2. With the Liebert FPC On, measure and record the DC control voltage on terminals 1 (+) and 3 (com).

___ 3. Control Voltage = _____ (Voltage should be between 16 and 23VDC).

### Customer Alarms

If customer alarms are provided:

___ 1. With the Liebert FPC On, simulate alarm operation by jumpering the appropriate low-voltage control terminals. (Refer to the control wiring installation drawing furnished with the unit.)

___ 2. Verify correct alarm annunciation by the Power Monitor Panel and/or by the Centralized Monitoring System.

## 3.4 Equipment Connection Check-Out of Units With Distribution Cables

# WARNING

Risk of electric shock and arc flash. Can cause injury and death.

All loads should be disconnected or turned Off before proceeding with the following steps.

For units with output distribution cables, be sure that NO output receptacles are connected to load equipment plugs and that the receptacles are not in contact with foreign objects.

Pay special attention to those output cables intended for direct wiring connection; the exposed conductor ends of these cables must not be in contact with each other or with any foreign objects.

___ 1. Turn on main input power to the unit, then turn On the panelboard main output breaker(s).

___ 2. Individually turn On each branch circuit breaker and check the output voltage (also phase rotation, if a 3-phase circuit) at the receptacle or cable end.

___ 3. Turn Off all branch circuit breakers and the panelboard main output circuit breaker(s).

___ 4. Connect the load equipment per equipment manufacturer's specifications and recommendations.

___ 5. Turn on the panelboard main output breaker(s).

___ 6. Turn on branch circuit breakers to the load equipment.

# NOTICE

Risk of improper startup. Can cause equipment damage reduced equipment life.

The connected load must be started according to the sequence recommended by the equipment manufacturer. Observe the power-up sequence recommended by the equipment manufacturer.

___ 7. Verify that all load equipment operates properly.

___ 8. Replace all unit panels. After performing the inspection and startup procedure described in **3.0 - Inspection and Startup Checklist** in this manual, complete the Startup and Inspection form furnished with the unit, sign the completed form and return it to:

Liebert® Corp.
1050 Dearborn Drive
P.O. Box 29186
Columbus, Ohio 43229 USA

**NOTE**

*Warranty is not in effect until the inspection and startup form is received by the factory.*

# 4.0 OPERATING INSTRUCTIONS

## 4.1 Startup Procedures

Before the unit is placed into service after initial installation, after equipment relocation, or after equipment has been de-energized for an extended period of time, perform equipment inspection and startup procedures as detailed in **2.0 - Equipment Inspection and Startup** and **3.0 - Inspection and Startup Checklist**.

After initial system startup, the following guidelines can be used for standard equipment operation. These guidelines should be reviewed for any special equipment modifications, special site considerations or company policies that may require changes to the standard equipment operation.

### 4.1.1 Emergency Shutdown—If Emergency Power Off switch is supplied

To perform an immediate system shutdown during emergency conditions, rotate the clear protective cover and push the Emergency Power Off (EPO) switch on the Liebert® FPC™'s monitoring panel.

**NOTE**
*Depending on the particular control circuit wiring, operation of the unit EPO switch may cause other equipment to also shutdown.*

If the site is equipped with a Remote Emergency Power Off (REPO) switch to perform an immediate room shutdown, actuate one of the REPO switches.

### 4.1.2 Normal System Shutdown

To perform a normal system shutdown, perform an orderly load equipment shutdown according to the load equipment manufacturer's recommended shutdown sequence. The load equipment can be turned Off at each piece of load equipment or at the Liebert FPC's output distribution (circuit breaker) panels located behind the Liebert FPC's front door. Turn Off all unit output breakers, then turn Off the unit's main input circuit breaker. To remove all power from the Liebert FPC, turn Off the building power to the Liebert FPC's input breaker or junction box.

### 4.1.3 Normal System Turn On

Make certain all of the Liebert FPC's circuit breakers are in the Off position. All unit circuit breakers are located behind the front doors. Turn On building power to the Liebert FPC. Turn On the Liebert FPC's main input circuit breaker. If the circuit breaker has been tripped Off (instead of being turned Off), the circuit breaker handle must be moved to the Off position before being turned On. If the Liebert FPC has a voltage monitoring panel, verify proper output voltages before turning On output circuit breakers. Turn On the panelboard main breakers. Turn On each output circuit breaker following the load equipment manufacturer's startup sequence.

### 4.1.4 Manual Restart

The Manual Restart feature is designed to cause the unit's main input circuit breaker to trip upon power failure, preventing repetitive application of unstable voltage and allowing for an orderly system restart. If the main input circuit breaker is tripped upon a power failure, wait until power is restored, then follow the instructions in **4.1.3 - Normal System Turn On**.

### 4.1.5 Auto Restart

If the Auto Restart feature is selected the unit's main input breaker will not trip upon power failure, Auto Restart does not affect the Emergency Power Off circuit—both local and remote EPO switches will trip the main input breaker when pressed.

Auto Restart can be field-selected by sliding the S1 switch on the adapter board to the **Auto** position. The adapter board is located on top of the monitoring enclosure. See **Figure 15**) for details.

## 4.2 Basic Monitor Panel

Basic Monitoring provides transformer overtemperature alarm, transformer overtemperature shutdown and Emergency Power Off controls only.

### Display Controls and Indicators

- **Power Indicator (Green LED)** - illuminates when power has been applied to the Liebert Power product.
- **Alarm Status Indicator (Red LED)** - illuminates when an alarm is present. The LED will remain illuminated until the alarm condition is cleared.
- **Audible Alarm speaker** (represented by the speaker symbol) - a speaker behind the bezel will sound when there is an alarm condition.
- **Silence/Reset Push Button** - pressing the Silence/Reset button will silence the audible alarm. Press the button a second time to clear the alarm and turn off the red alarm indicator LED.
- **LCD** - Not used
- **Emergency Power Off (EPO) Push Button** - pressing the EPO button shunt trips the input circuit breaker to turn the unit off.
- **Navigation keys** (soft function keys F1 through F4 and Help) - Not used.

If an overtemperature condition occurs—when the transformer temperature exceeds 356°F (180°C)—it should be investigated and corrected. Possible causes include transformer overload, excessive non-linear loading, inadequate ventilation, high or low input voltage and monitoring malfunction.

Failure to correct the overtemperature condition may result in an automatic system shutdown due to the second stage of overtemperature sensing, when the transformer temperature exceeds 392°F (200°C). After the alarm condition is corrected, the alarm will automatically reset.

See **Figure 13** for remote summary alarm and Remote Emergency Power Off switch connections.

## 4.3 Power Monitor Panel

Liebert Power Monitor Panel with Velocity protocol (VPMP) provides input voltage, output current and voltage and other power parameters and will detect and annunciate alarm messages. The monitored parameters and alarms will be displayed on the local display and be available for communication to a customer or Liebert monitoring system.

The VPMP includes a monochrome Liquid Crystal Display (LCD), power and alarm LEDs, an audible alarm and alarm silence and Emergency Power Off push buttons mounted on the front door.

### Display Controls and Indicators

- **Power Indicator (Green LED)** - illuminates when power has been applied to the Liebert Power product.
- **Alarm Status Indicator (Red LED)** - illuminates when the VPMP detects an alarm. The LED will remain illuminated until the alarm condition is cleared.
- **Audible Alarm speaker** (represented by the speaker symbol) - a speaker behind the bezel will sound when the Liebert VPMP records an alarm condition.
- **Silence/Reset Push Button** - pressing the Silence/Reset button will silence the audible alarm. Press the button a second time to clear the alarm and turn off the red alarm indicator LED if the alarm has cleared.
- **Emergency Power Off (EPO) Push Button** - pressing the EPO button shunt trips the input circuit breaker to turn the unit off.
- **LCD** - displays power parameters and alarm data.
- **Navigation keys** (soft function keys F1 through F4 and Help):
  - **F1** selects the next Main Breaker or Next Subfeed.
  - **F2** is the Sequence key. It selects the next set of items at the current level or the next item on a list.
  - **F3** can select Subfeed (if supplied and monitored) at the top level or can select a menu item at a lower level.
  - **F4** can select Branch a Back function at lower levels.

    Pressing the Back key (F4) navigates to the top level (Main) except from the Help screen.

    From the Help screen, the Back key navigates to the previous screen.
  - Pressing the **Help** key navigates to the Help screen.

All alarm thresholds for monitored parameters are adjustable by way of the VPMP DB-9 setup port to match site requirements. All alarms are stored in non-volatile memory to protect against erasure by a power outage. Alarms must be reset manually after the alarm condition has been corrected. Alarms may be reset by pushing the Silence/Reset button on the display or through the remote monitoring system (if used).

The following metering parameters may be displayed:

- Input Voltage, Line-to-Line for all three phases
- Output Voltages, Line-to-Line for all three phases
- Output Voltages, Line-to-Neutral for all three phases
- Output Voltage Total Harmonic Distortion (THD) for all three phases
- Output Current for all three phases
- Output Current Total Harmonic Distortion (THD) for all three phases
- Output Current Crest Factor (Peak/RMS) for all three phases
- Output Current Harmonic K-Factor for all three phases
- Output Neutral Current
- System Ground Current
- Output Frequency
- Output kVA
- Output kW
- Output Power Factor
- Output kW-Hours
- Percent Load
- Date
- Time

The VPMP detects and annunciates by alarm message the following conditions:

- Output Overvoltage
- Output Undervoltage
- Output Overcurrent
- Neutral Overcurrent
- Ground Overcurrent
- Output Voltage Distortion
- Frequency Deviation
- Phase Sequence Error
- Phase Loss
- Transformer Overtemperature

All alarm thresholds for monitored parameters are adjustable by way of the VPMP DB-9 setup port to match site requirements. The factory setpoints for the alarms are as follows:

- **Output Overvoltage** - output voltage exceeds +6% of nominal
- **Output Undervoltage** - output voltage falls below - 13% of nominal
- **Output Overcurrent** - output current exceeds 95% of full load amps
- **Neutral Overcurrent** - neutral current exceeds 95% of full load amps
- **Ground Overcurrent** - ground current exceeds:
  - 5 amps (15-125kVA)
  - 10 amps (150-225kVA)
  - 15 amps (300kVA)
- **Output Voltage Distortion** - output voltage THD exceeds 10%
- **Frequency Deviation** - output frequency exceeds ±0.5Hz of nominal

**Summary Alarm**

- **Summary Alarm** - detects and annunciates any alarm.

**Summary Alarm Contacts**

- The VPMP has a form C (one NO and one NC) summary alarm contacts for remote alarm status. The contacts are rated at 24VAC @ 1A. There is one alarm contact per breaker. The contacts change state upon occurrence of any alarm including warnings and resets when the alarm is cleared. Summary alarm contacts are located on the adapter board. The adapter board is located on top of the monitoring enclosure. See **Figure 15** for details.

**Communication** - Liebert IntelliSlot® cards provide customer connections to a Building Management System (BMS) or Remote Monitoring Systems. The following cards are available:

- **IS-WEBS Card** - provides SNMP/WEB output. An RJ-45 connector is supplied for customer connection to Ethernet LAN.
- **IS-485S Card** - provides Modbus 485 output. A terminal strip is provided for 2-wire connection.
- **IS-IPBMS Card** - provides Modbus IP output. An RJ-45 connector is supplied for customer connection

Up to three cards can be plugged into the Liebert IntelliSlot ports provided with the VPMP system.

If communication to Liebert SiteScan® is required, customer connection can be made to the adapter board RS-485 terminals on TB1, see **Figure 15** for details. The adapter board is located on top of the monitoring enclosure.

## 4.4 Liebert Current Plus Monitoring (If Supplied)

Liebert Current Plus Monitoring (Liebert CPM) provides the current and voltage of each panelboard main circuit breaker. These measurements are used for reporting the average RMS current, power and other parameters. The Liebert CPM detects and annunciates alarm messages and status conditions for each panelboard main circuit breaker. The monitored parameters and alarms appear on the local display and are available for communication to a customer or Liebert monitoring system.

The Liebert CPM includes a monochrome LCD, power and alarm LEDs, an audible alarm and alarm silence and Emergency Power Off push buttons mounted on the front door.

### Display Controls and Indicators

- **Power Indicator (Green LED)** - illuminates when power has been applied to the Liebert Power product.
- **Alarm Status Indicator (Red LED)** - illuminates when the Liebert CPM detects an alarm. The LED will remain illuminated until the alarm condition is cleared.
- **Audible Alarm speaker** (represented by the speaker symbol) - a speaker behind the bezel will sound when the Liebert CPM records an alarm condition.
- **Silence/Reset Push Button** - pressing the Silence/Reset button will silence the audible alarm. Press the button a second time to clear the alarm and turn off the red alarm indicator LED if the alarm has cleared.
- **Emergency Power Off (EPO) Push Button** - pressing the EPO button shunt trips the input circuit breaker to turn the unit off.
- **LCD** - displays power parameters and alarm data.
- **Navigation keys** (soft function keys F1 through F4 and Help):
  - **F1** selects the next Main Breaker.
  - **F2** is the Sequence key. It selects the next set of items at the current level or the next item on a list.
  - **F3** can select a menu item.
  - **F4** can provide a Back function at lower levels.
    Pressing the Back key (F4) navigates to the top level (Main) except from the Help screen.
    From the Help screen, the Back key navigates to the previous screen.
  - Pressing the **Help** key navigates to the Help screen.

All alarm thresholds for monitored parameters are adjustable by way of the DB-9 setup port to match site requirements. All alarms are stored in non-volatile memory to protect against erasure by a power outage. Alarms must be reset manually after the alarm condition has been corrected. Alarms may be reset by pushing the Silence/Reset button on the display or through the remote monitoring system (if used).

The Liebert CMP monitors and displays the following parameters for the panelboard main circuit breaker:

- Phase Current
- Percent Load
- kW
- kW-Hours

The following metering parameters may be displayed:

- Voltage - Line-to-Line
- Voltage - Line-to-Neutral
- Neutral Current
- Ground Current
- kVA
- Power Factor
- Voltage Total Harmonic Distortion (THD)
- Current Total Harmonic Distortion (THD)
- Crest Factor

Circuit identification and status of each breaker may be displayed.

The Liebert CPM detects and annunciates by alarm message the following conditions:

- Overvoltage
- Undervoltage
- Neutral Overcurrent
- Ground Overcurrent
- Phase Overcurrent
- Phase Overcurrent Warning
- Summary Alarm

All alarm thresholds for monitored parameters are adjustable by way of the DB-9 setup port to match site requirements. The factory setpoints for the alarms are as follows:

- **Overvoltage** - at least one of the line-to-line voltages exceeds +6% of nominal
- **Undervoltage** - at least one of the line-to-line or line-to-neutral voltages falls below -13% of nominal
- **Phase Overcurrent Warning** - current exceeds 75% of breaker amps
- **Phase Overcurrent** - current exceeds 80% of breaker amps
- **Neutral Current** - current exceeds 95% of breaker amps
- **Ground Current** - current exceeds 5 amps

**Summary Alarm**

- **Summary Alarm** - detects and annunciates any alarm.

**Summary Alarm Contacts**

- The CPM has a form C (one NO and one NC) summary alarm contacts for remote alarm status. The contacts are rated at 24VAC @ 1A. There is one alarm contact per breaker. The contacts change state upon occurrence of any alarm including warnings and reset when the alarm is cleared. Summary alarm contacts are on the adapter board. The adapter board is on top of the monitoring enclosure. See **Figure 15** for details.

**Communication** - Liebert IntelliSlot® cards provide customer connections to a Building Management System (BMS) or Remote Monitoring Systems. The following cards are available:

- IS-WEBS Card - Provides SNMP/WEB output. An RJ-45 connector is supplied for customer connection to Ethernet LAN.
- IS-485S Card - Provides Modbus 485 output. A terminal strip is provided for two-wire connection.
- IS-IPBMS Card - Provides Modbus IP output. An RJ-45 connector is supplied for customer connection. Up to three cards can be plugged into the Liebert IntelliSlot ports provided with the VPMP system.

If communication to Liebert SiteScan® is required, customer connection can be made to the adapter board RS-485 terminals on TB1, see **Figure 15** for details. The adapter board is on top of the monitoring enclosure.

## 4.5 Liebert Distribution Monitoring (If Supplied)

The Liebert Distribution Monitoring (Liebert LDMF) provides the current and voltage for each branch circuit breaker mounted on the panelboards and the panelboard main circuit breaker. These measurements are used for reporting the average RMS current, power and other parameters. The Liebert LDMF detects and annunciates alarm messages and status conditions for each branch circuit breaker and the panelboard main circuit breaker. The monitored parameters and alarms appear on the local display (if supplied) and are available for communication to a customer or Liebert monitoring system.

The Liebert LDMF (if supplied) includes a monochrome LCD, power and alarm LEDs, an audible alarm and alarm silence and Emergency Power Off push buttons mounted on the front door.

### Display Controls and Indicators

- **Power Indicator (Green LED)** - illuminates when power has been applied to the Liebert Power product.
- **Alarm Status Indicator (Red LED)** - illuminates when the Liebert LDMF detects an alarm. The LED will remain illuminated until the alarm condition is cleared.
- **Audible Alarm speaker** (represented by the speaker symbol) - a speaker behind the bezel will sound when the Liebert LDMF records an alarm condition.
- **Silence/Reset Push Button** - pressing the Silence/Reset button will silence the audible alarm. Press the button a second time to clear the alarm and turn off the red alarm indicator LED if the alarm has cleared.
- **Emergency Power Off (EPO) Push Button** - pressing the EPO button shunt trips the input circuit breaker to turn the unit off.
- **LCD** - displays power parameters and alarm data.
- **Navigation keys** (soft function keys F1 through F4 and Help):
  - **F1** selects the next Main Breaker, Next Subfeed or Next Branch.
  - **F2** is the Sequence key. It selects the next set of items at the current level or the next item on a list.
  - **F3** can select Subfeed (if supplied and monitored) at the top level or a menu item at a lower level.
  - **F4** can select Branch Breakers at the top level or provide a Back function at lower levels. Pressing the Back key (F4) navigates to the top level (Main) except from the Help screen. From the Help screen, the Back key navigates to the previous screen.
  - Pressing the **Help** key navigates to the Help screen.

All alarm thresholds for monitored parameters are adjustable by way of the LDMF DB-9 setup port to match site requirements. All alarms are stored in non-volatile memory to protect against erasure by a power outage. Alarms must be reset manually after the alarm condition has been corrected. Alarms may be reset by pushing the Silence/Reset button on the display or through the remote monitoring system (if used).

The Liebert LDMF monitors and displays the following parameters for the panelboard main circuit breaker, each branch circuit breaker and subfeed circuit breakers (if supplied and monitored):

- Phase Current
- Percent Load
- kW
- kW-Hours

The following metering parameters may be displayed:

- Voltage - Line-to-Line
- Voltage - Line-to-Neutral
- Neutral Current
- Ground Current
- kVA
- Power Factor
- Voltage Total Harmonic Distortion (THD)
- Current Total Harmonic Distortion (THD)
- Crest Factor

Circuit identification and status of each breaker may be displayed.

The Liebert LDMF detects and annunciates by alarm message the following conditions:

- Overvoltage
- Undervoltage
- Neutral Overcurrent
- Ground Overcurrent
- Phase Overcurrent
- Phase Overcurrent Warning
- Summary Alarm

All alarm thresholds for monitored parameters are adjustable by way of the LDMF DB-9 setup port to match site requirements. The factory setpoints for the alarms are as follows:

- **Overvoltage** - at least one of the line-to-line voltages exceeds +6% of nominal
- **Undervoltage** - at least one of the line-to-line or line-to-neutral voltages falls below -13% of nominal
- **Phase Overcurrent Warning** - current exceeds 75% of breaker amps
- **Phase Overcurrent** - current exceeds 80% of breaker amps
- **Neutral Current** - current exceeds 95% of breaker amps
- **Ground Current** - current exceeds 5 amps

**Summary Alarm**

- **Summary Alarm** - detects and annunciates any alarm.

**Summary Alarm Contacts**

- The LDMF has a form C (one NO and one NC) summary alarm contacts for remote alarm status. The contacts are rated at 24VAC @ 1A. There is one alarm contact per breaker. The contacts change state upon occurrence of any alarm including warnings and resets when the alarm is cleared. Summary alarm contacts are located on the adapter board. The adapter board is located on top of the monitoring enclosure. See **Figure 15** for details.

**Communication** - Liebert IntelliSlot cards provide customer connections to a Building Management System (BMS) or Remote Monitoring Systems. The following cards are available:

- **IS-WEBS Card** - Provides SNMP/WEB output. An RJ-45 connector is supplied for customer connection to Ethernet LAN.
- **IS-485S Card** - Provides Modbus 485 output. A terminal strip is provided for 2-wire connection.
- **IS-IPBMS Card** - Provides Modbus IP output. An RJ-45 connector is supplied for customer connection.

Up to three cards can be plugged into the Liebert IntelliSlot ports provided with the Liebert LDMF system.

If communication to Liebert SiteScan is required, customer connection can be made to the adapter board RS-485 terminals on TB1, see **Figure 15** for details. The adapter board is located on top of the monitoring enclosure.

# 5.0 MAINTENANCE

## 5.1 Repair

Even the most reliable equipment may fail. Liebert Services is at your service to assure fast repair of your unit and minimum downtime of your installation.

**WARNING**

Risk of electric shock and arc flash. Can cause equipment damage, injury and death.

Only properly trained and qualified service personnel wearing appropriate safety headgear, gloves, shoes and glasses should perform maintenance on the Liebert® FPC™ system.

Standard electrical troubleshooting procedures should be used to isolate problems in the unit. If there are questions, don't hesitate to contact Liebert Services.

Repair or replacement of standard items, such as circuit breakers, fuses, transformers, capacitors and indicator lights can either be handled by qualified electricians or referred to Liebert Services.

Repairs related to the monitoring system should be referred to Liebert Services. To contact Liebert Services for information or repair service in the United States, call 1-800-LIEBERT.

## 5.2 Inspection and Cleaning

Air circulation through the cabinet may cause dust to accumulate on internal components. Cleaning should be done as necessary during electrical inspections.

Annual general system inspections, cleaning, and operation checks are recommended to ensure system performance and long service life.

**WARNING**

Risk of electric shock and arc flash. Can cause equipment damage, injury and death.

Only properly trained and qualified service personnel wearing appropriate safety headgear, gloves, shoes and glasses should perform maintenance on the Liebert FPC system. All voltage sources to the unit must be disconnected before inspecting or cleaning within the cabinet.

### 5.2.1 Inspection Schedule

- It is difficult to establish a schedule for periodic cleanings because conditions vary from site to site. Inspections after the first 24 hours, 30 days and 6 months of operation should help determine a pattern for the inspection schedule.
- Electrical connections and component mountings should be inspected after the first 24 hours, 30 days, and 6 months of operation. Inspections should be conducted annually thereafter.
- Ventilation openings and grilles should be inspected and cleaned every 6 months to one year.
- A complete inspection and operational checkout should be performed annually. This is best done by performing the inspection and startup procedure as detailed in **3.0 - Inspection and Startup Checklist**.
- Liebert Services offers a complete range of preventive maintenance services. These include thorough equipment performance checks and calibration of electronics. Contact Liebert Services in the United States by calling 1-800-LIEBERT for details.

# *Ensuring The High Availability Of Mission-Critical Data And Applications.*

**Emerson Network Power, a business of Emerson (NYSE:EMR), is the global leader in enabling *Business-Critical Continuity™* from grid to chip for telecommunication networks, data centers, health care and industrial facilities. Emerson Network Power provides innovative solutions and expertise in areas including AC and DC power and precision cooling systems, embedded computing and power, integrated racks and enclosures, power switching and controls, infrastructure management, and connectivity. All solutions are supported globally by local Emerson Network Power service technicians. Liebert AC power, precision cooling and monitoring products and services from Emerson Network Power deliver Efficiency Without Compromise™ by helping customers optimize their data center infrastructure to reduce costs and deliver high availability.**


**Technical Support / Service**

**Web Site**
www.liebert.com

**Monitoring**
liebert.monitoring@emerson.com
800-222-5877
Outside North America: +00800 1155 4499

**Single-Phase UPS & Server Cabinets**
liebert.upstech@emerson.com
800-222-5877
Outside North America: +00800 1155 4499

**Three-Phase UPS & Power Systems**
800-543-2378
Outside North America: 614-841-6598

**Environmental Systems**
800-543-2778
Outside the United States: 614-888-0246

**Locations**

**United States**
1050 Dearborn Drive
P.O. Box 29186
Columbus, OH 43229

**Europe**
Via Leonardo Da Vinci 8
Zona Industriale Tognana
35028 Piove Di Sacco (PD) Italy
+39 049 9719 111
Fax: +39 049 5841 257

**Asia**
29/F, The Orient Square Building
F. Ortigas Jr. Road, Ortigas Center
Pasig City 1605
Philippines
+63 2 687 6615
Fax: +63 2 730 9572



While every precaution has been taken to ensure the accuracy and completeness of this literature, Liebert Corporation assumes no responsibility and disclaims all liability for damages resulting from use of this information or for any errors or omissions.
© 2011 Liebert Corporation
All rights reserved throughout the world. Specifications subject to change without notice.
® Liebert is a registered trademark of Liebert Corporation.
All names referred to are trademarks or registered trademarks of their respective owners.



SL-20417_REV2_08-12


**Emerson Network Power.**
The global leader in enabling *Business-Critical Continuity™*

**EmersonNetworkPower.com**

- **AC Power**
- Connectivity
- DC Power
- Embedded Computing
- Embedded Power
- Infrastructure Management & Monitoring
- Outside Plant
- Power Switching & Controls
- Precision Cooling
- Racks & Integrated Cabinets
- Services
- Surge Protection


Emerson, *Business-Critical Continuity*, Emerson Network Power and the Emerson Network Power logo are trademarks of Emerson Electric Co. or one of its affiliated companies.
©2011 Emerson Electric Co.